ENGINEERS AND ENGINEERING IN OTHER LANDS.

Translated and Prepared from our Exchanges.]

It is very unfortunate for engineering projects just at present that there exists such political jealousy among the nations. There was every prospect of having a regular "tunnel-mania." But the military have almost crushed out the project of a tunnel between England and France, while the Egyptian question threatens to interfere for some time with a great many undertakings in the Orient. Some of the Spanish generals are also opposing the tunneling of the Pyrenees, but here, at least, they are not likely to meet with much success. Such proceedings as these do not certainly merit the title of "civil" engineering, in more than one sense of the word.

News from Panama continues favorable, a great many Blacks and Chinese continue to arrive, and villages are springing up. It would be hard, however, to understand why one of them should be termed "Monkey Hill;" it doubtless indicates the presence of some irreverent American who is a believer in the Darwinian theory. More than 1,200 soundings have been made in the Bay of Colon, and the currents, winds, tides, etc., have been carefully studied. The question of the outlet on the Pacific is now in order, but the damming of the Gamboa will offer a great many difficulties. The expenses up to June, 1881, were some forty million francs. However, the immense success of the Suez Canal ought to have a cheering effect on the Panama men. The receipts in 1881, were 51,274,352 francs, while even in 1880, the best previous year, they amounted to only 39 millions.

The question of deepening the Seine is still discussed by our French *confréres*. Very contradictory plans have been presented. That of M. Frimot is to have a series of ten dams, so as to raise the level, and then to dredge the shallow places. Here, however, difficulties come in, the dams are likely to increase the inundations in times of freshets, but it is thought that the moveable dams as suggested by Poirée and Boulé will completely overcome this objection. Rivers are divided by M. de la Grye into three categories; those which carry along with them a quantity of matter torn from their banks; those which simply change their beds; and those which have but a slow current and carry along little or nothing. He classes the Seine in this last category, and he maintains that the bed of such a river is sinuous. This view is not accepted by M. Cotard who believes the sinuous form is not caused by the absence of drifted matter, but from the weakness of the bed, by which a stream has to lengthen its course until the slope and speed diminishing there is an equilibrium between the action of the current and the resistance of the soil. The project for the Seine as presented is to dredge the river from Rouen to Poissy, so as to create a channel of 45 metres in width at bottom. The scheme presented does not seem to solve the problem, and it was objected that the result of such a drain would be most injurious to agricultural interests. The system of sluices, which are to be all concentrated at Poissy, does not appear to be very practical.

Most of us remember the great inundation a few years ago, which almost completely destroyed the city of Szegedin, the most important place in Hungary after Pesth. The new bridge to be built over the Theiss and which was to cost altogether some 2,600,000 francs was the subject of a lively competition. The length of the bridge was to be 375 metres. Twelve houses put in 23 plans and bids. Paris, Brussels, Amsterdam and other places competed, but the committee unanimously adopted the plan of a bridge with arches of M. G. Eiffel of Paris. The land abutment and the principal pier in the river will be laid by means of compressed air at a depth of 18 metres below low water mark.

ARTIFICIAL BLOCKS OF MASONRY.

Artificial ashlar work has been largely used in the port of Fiume, which has lately become such a rival to Trieste. The blocks used were uniformly 3 metres 70 cent. in length; 2 metres in width, and 1 metre 50 cent. in height (Fig. 1). The interior cubed 11 metres 10 cent. was built with rubble stone, but the front facings were of cut stone of a maximum weight of 10 kilos. Each block weighed from 26,000 to 27,000 kilos. They were allowed to dry three months before using, in summer two months only. It is necessary that dessication should not be rapid, and at the beginning the blocks should be watered twice, and afterward once a day. The strength of the material is tested in the following way. One of the blocks

FIG. 1. FIG. 2. FIG. 3.

was placed after 83 days on rails *a*, *b*, *c*, *d*, which caught into grooves made on lower face (Fig. 2). The rails were supported by wooden posts about 2½ feet in height. The earth was then taken away from beneath, so as to leave the block entirely free. It was then overturned by means of screw-jacks. When the block fell, its corner D struck the ground obliquely, and sunk into it Fig. 3, and a fissure *o*, *p*, *q*, of one millimetre in width was produced. A second cleft *r*, *s*, was just observable on the lateral wall. The block was left some time, and then broken up to ascertain the injuries inside. The masonry was found perfectly dry, and the defects solely attributed to the quality of the material used. Of 3,794 such blocks used in the port only some 19 were found imperfect. The cost was far less than for blocks of Portland Cement, those of that kind used at Cherbourg, Port Said, and Trieste cost respectively 55, 42 and 28 fr. per cubic metre. The Fiume blocks cost only 20 fr. 50 cent. per cubic metre.

SPECIFICATIONS OF THE METROPOLITAN BOARD OF WORKS.

PAVING, &C., IN HORSELYDOWN AND BERMONDSEY.

This specification refers to works to be done in Freeschool street and Thornton street, New street and Fashion street, St. John, Horselydown, and in Jamaica road, Bermondsey, in the County of Surrey.

The works comprise the formation of paved carriage-ways and foot-ways, &c., as per drawings, Nos. 1, 2 and 3. Also, the maintenance of the whole of the same in thorough repair for 12 months after completion.

The ground on one side of Freeschool, Thornton, New and Fashion streets, and Jamaica road, Bermondsey, up to the proposed new frontage lines shown on plans is, without extra charge, to be raised or filled up with dry rubbish, gravel or other material, of approved quality, well watered and punned in layers; or reduced to the levels shown upon the drawings, and to the widths required. Previous to laying the foot-ways and the concrete foundations of the carriage-ways the ground shall, as part of and included in the contract, be reduced to uniform surfaces at the proper level by filling or excavating, as the case may be; and in the former case the filling shall be formed of brick rubbish or gravel, or such, if any, material excavated from the site of the works, or such other as may be approved by the engineer. In all cases the materials used for filling in shall be well watered, and afterwards punned or rolled, as may be directed by the engineer, so as thoroughly to consolidate the ground to his satisfaction previously to laying the concrete and paving. All vaults shall be broken up, and all cavities or open spaces filled in and solidly rammed. From the "Three Compasses" P. H., along the main thoroughfare to Dockhead as shown upon the drawings, a line of tramway is to be formed by the contractor. The whole of the iron work for this, as shown upon drawing No. 3, will be supplied by the tramway company; but the rails are to be laid, and all other materials and labor supplied, by the contractor; this part of the work being done to the satisfaction of the engineer to the tramway company, and in accordance with the following conditions: The rails are to be laid to true curves, being bent and straightened, where necessary, by crowing, and not by hammering. Any rivets which may be loosened by crowing the rails shall be cut out and replaced. All joints to be brought fair and true, and to have steel shoes, as shown on drawing. Cutting the rails, except at the proper position with respect to the pitch of the rivetting, is to be avoided; but where unavoidable the rails are to be fished to the satisfaction of the engineer. The rails are to be laid to such gradients as may be required by the fall of the road, and shall be bedded on fine concrete, composed of one part of Portland cement to one part of screened Thames ballast. The bedding is to be perfectly solid under every part of the rail, and to ensure this, beating hammers of approved form should be used for packing. When the rails are bedded the whole surface of the concrete shall be made up with similar fine concrete to within half an inch of the extreme depth of the stones below the finished level of the surface. The rails shall be laid to a gauge, the particulars of which shall be supplied by the engineer, and a standard gauge bar shall be prepared for the engineer's use, and left in his charge during the progress of the works. The paving between the outer rails shall be of Guernsey granite sets of 7 in. in depth and 4 in. in thickness, no stone being longer than 12 in. During the progress of the paving the rails shall be kept in place by temporary tie bars of Tee iron about 3 in. by 2½ in., with notches in the web to fit the heads of the rails, which should be placed about 8 ft. apart, and removed as the paving proceeds. The finished level of the paving adjacent to the rails to be about a quarter of an inch above them.

The carriageways, being 7,245 superficial yards, shall be formed of Aberdeen or Guernsey granite cubes or sets, 7 in. in depth and 4 in. wide on bed, carefully dressed and free from protuberances on surface, laid to a uniform surface on a bed of Portland cement concrete, 9 in. thick, and being 2,060 cubic yards, the surface of both granite and concrete being formed as may be directed. After this bed of concrete has set hard, the cubes or sets are to be bedded on a thin layer of Portland cement concrete spread over the concrete foundation, laid in regular straight courses, and properly bonded and toothed into each other, so close at joints that six courses, when laid and finished, shall not measure more than 27 in., leaving only sufficient space for grouting to pass to the bottom; to be well rammed, and back rammed as directed by the engineer, to a uniform surface, and well grouted with sharp sand and Portland cement in the proportion of four to one, and coated with fine hoggin. The crossings, being 308 superficial yards, shall be of granite cubes, the same as the carriageways, but specially dressed for crossings, laid in the same way as the ordinary paving, having the same curvature as the carriageway across which they are laid. As the local traffic must be kept uninterrupted, it will only be possible to pave one side at a time, except in Freeschool and Thornton streets.

The channels, 3,650 ft. in length, shall be formed of Guernsey granite stones, 7 in. deep and 12 in. wide; no stone to be less than 2 ft. 6 in. in length, all laid on a bed of Portland cement concrete, as shown; the stones to be worked fair on upper surface, equal to sample, with joints squared throughout the whole depth or thickness, closely laid and well grouted with Portland cement, as before specified, as the work proceeds. The channels to be laid with a fall towards the gullies, as may be directed. The kerb (which is partly curved, as shown on the plan) for margin to the footway paving, 3,510 ft. in length, shall be of new Aberdeen or Guernsey granite laid in cement mortar on a bed of Portland cement concrete. The stones to be 8 in. deep and 12 in. wide on bed, to be worked fair and fine, dressed on two faces equal to sample.

The heading joints to be neatly squared through for their entire depth, and the back joints with York paving to be squared for a depth of at least three inches. No stone to measure less than 3 ft. in length. The footway paving to be specially rounded at curves, as directed and the kerbstones shaped to correspond. The footway paving 32,490 ft. sup., shall be of new 3-in. York stone, sound and hard, and of a uniform and close texture, free from sand holes and other defects, and to dry after rain of a light color, as nearly as possible uniform throughout. The flags to be of full thickness throughout, thoroughly tooled to a fair, clean, level and true surface, equal to sample, and the joints tooled square. The stones to be laid in lias mortar on a sufficient bed of fine sand, gravel, or other approved material, with close and neat joints, and in uniform courses, breaking bond, the courses of new paving to be at least 1 ft. 10 in., and not more than 2 ft. 9 in. wide, no two adjoining courses to differ in width more than 3 in., and no new stone to be of less area than 5 ft., except for such closers as may be allowed; the joints to be dressed and rubbed down after laying, where necessary, to preserve a uniform surface throughout. The paving to be laid with slope toward the carriageway.

Wherever the new works intersect with or end in the existing streets or places, the whole road and footway works shall, without extra charge, be taken up and relaid to such extent as the engineer may consider necessary, and the best of the old materials taken up in any part of the work are to be used therein. Where the levels of the existing footways are to be altered, the contractor will have, without extra charge, to alter the levels, the area gratings, railings and kerbs, and the steps and landings giving access to the premises in such manner as may be directed.

The contractor shall provide and lay 250 ft. run of 15-in. pipe sewer, bedded on Portland cement concrete in accordance with cross-section No. 4, including twenty junctions extra on. Also 3,100 ft. run of 6-in. stoneware pipe sewer without a concrete bedding therefor. The above lengths of pipes to be distributed as indicated on the drawings, or in any manner the engineer may direct, including making good connections of existing drains with existing brick sewers and proposed sewers. Also shall supply and fix within the existing sewers, in accordance with directions which will be given by the engineer, eighty 6-in. and one 15-in. galvanized iron tide-flaps similar to samples. Thirty-six gullies to be formed in brickwork in cement, with syphon traps and connected with the sewer by 6-in. stoneware pipes, which are included in the pipes provided. The gullies to be fitted with cast-iron gratings, to be supplied and fixed by the contractor (see Drawing No. 1).

The contractor shall provide and erect 18 new substantial cast-iron street lamps in such situations on the works as the engineer may direct, either to same design and dimensions as those now in the locality, or, to some other as shall be ordered, including copper lantern properly glazed, with copper door and ventilator to same, and ladder iron to each lamp, and shall shift, as may be directed, the existing lamps, six in number, and make good the connections with the service pipes. The whole of the said street lamps, new and old, are to be painted in four oils, finished, bronze color and furnished (in manner to be approved) with gas pipes, burners, and fittings. The gas piping to be provided and laid by the contractor, is to extend from the burners to the bottom of the street lamps, and thence to the main, with which it is to be connected. The contractor will have to supply the necessary bends, unions, nipples, and Tee pieces, and to leave the lamps complete and ready for lighting. The whole of the work to be executed in the best style of finished workmanship.

The pipes, bends, junctions, and drain-mouths shall be of the best stoneware, to be approved by the engineer, well burnt, salt-glazed, circular, perfectly true in bore, and straight, with whole socket joints, free from flaws, blisters, cracks, and other defects. Those of 12-in. or greater diameter are to be at least 1 in. in thickness. All junction pipes shall be molded with a proper curve. All the stoneware pipes shall be jointed with neat Portland cement, and laid by a bricklayer; and all materials and workmanship shall be of the best quality, and equal to samples to be seen at the offices of the board at Spring-gardens. All the surplus earth, rubbish, carriage and footway paving-stones, kerbing, or other old materials, not being private property, or claimed by the board for use in the proposed works, are to become the property of the contractor, and are to be carted away. The area of the present carriage-ways is about 4,750 yards superficial; and of footway paving about 17,900 ft. superficial. The present kerbs about 3,400 ft. in length, 12 in. by 6 in. on edge, and 300 ft. in length of 12 in. by 8 in. laid flat. If any of the existing road or footway paving is permitted to be used instead of new, only the labor of taking up, dressing and relaying is to be allowed for to the contractor. The existing boarding and fencing are not to become the property of the contractor, but to be removed as occasion requires, and to be deposited and stacked in such port on of the vacant ground along the line of works as may be directed.

The lime that may be required to be used in any part of the works shall be obtained from the lower or hardest beds of the blue lias formation, of quality equal to the best Aberthaw or Lyme Regis, brought in lumps fresh from the kiln. The lime to be turned over and wetted from the rose of a watering-can, covered up with sand, and allowed to remain till cold; then sifted through a fine sieve; about two and a half of sand is then to be added to one of lime and made into mortar, which is to remain for at least 24 hours before being used.

The whole of the cement for these works, and herein referred to, is to be Portland cement of the best quality, ground so fine that the residue on a sieve of 5,800 meshes to the square inch (equal to about 76 per lineal inch) shall not exceed 10 per cent. by weight. When tested, should the proportion which will not pass through this sieve be greater, a quantity of cement proportionate to such excess must be added. When brought upon the works it is to be put into a dry shed or store, which the contractor has to provide for the purpose, having a wooden floor and all necessary sub-divisions. The cement is to be emptied out upon this floor, every 10 tons being kept separate, and is not to be used until it has been tested by samples taken from different sacks. The cement is to be gauged with three times its weight of dry sand which has been passed through a sieve of 400, and been retained upon one of 900 meshes to the square inch. A sample of this sand may be seen at this office. The cement and sand having been well mixed, dry, about 10 per cent. of their weight of water is to be added, and briquettes formed in moulds of 1-in. sectional area at the weakest part. The briquettes, having in the meantime been kept in a damp atmosphere, are to be put into water twenty-four hours after they have been made, and remain in water until their tensile strength is tested by means of apparatus belonging to the board, and by their officers. The cement, neat, must not, at any season of the year, set in less than one hour, and must bear, without breaking, a weight of 200 pound per square inch 28 days after the briquettes have been made. If it does not, it will be rejected, and must be forthwith removed from the works. To secure due progress the contractor shall, immediately after the contract is signed, procure and deliver onto the site of the works a stock of cement sufficient for carrying upon works for at least five weeks, and at all times, until their approaching completion, shall keep stored on the works a quantity equal to five weeks' consumption. All cement concrete to be used throughout the works, with the exception of that under the tram rails, to be formed of one measure of Portland cement to eight measures of ballast. All lime concrete to be formed of one measure of lime to six measures of ballast. The whole to be thoroughly mixed and put into the works as may be directed.

The works are, without extra charge, to be carried on day and night without intermission should bad or treacherous ground be met with, or should there be any other cause whatsoever which in the judgment of the engineer shall require it. The contractor to provide, fit up and shift from one section of the work to another during the progress of the work, as shall be directed, a large, movable office for the accommodation of the clerks of the work, with all requisite fittings, stoves, firing, lighting, etc., so as to be habitable for working purposes at all times and under all circumstances; and at the completion of the work it shall become the property of, and be removed by, the contractor, who is also to supply the necessary laborers to attend the same, and to assist the clerk of works in taking levels, etc. The contractor to include in tender (in addition to all other things specified therein), and to provide the sum of £500 to be expended or used, either wholly or in part, or not to be used, at the discretion of the engineer, and entirely as he may decide and direct, but if no part, or only parts thereof, are used, then the whole, or the parts not used, shall be deducted from the amount of the contract; and in like manner any increase thereof shall be added to the said amount, and such works shall be deducted from or added to the amount of the contract in accordance with the terms specified in Clause 33 for regulating such diminished or extra works, or otherwise, as herein provided. Within seven days after the contract shall have been executed, the contractor shall deliver to the engineer full and true bills of quantities, with the rates of charge and the amounts of each item, and the total amount upon which the tender was based; and upon refusal or neglect to do so shall forfeit to the board £10 per day for every day that such refusal or neglect shall continue beyond the period specified, each sum to be deemed liquidated damages.

The contractor shall return to the custody of the engineer, at the time of the delivery up to the works of the board, and before he receives the installments payable thereon, all plans, drawings, writings, papers, specifications and documents which may have been delivered to him, or for his use; and, in the meantime, the engineer, and such person as he may appoint, and the assistant engineer and clerks of works, shall have full access thereto, at all times and for all purposes, and the same shall be kept at or near the site of the works. All coins, or other articles of antiquity or value, which may be discovered in the course of these works, shall be immediately delivered into the custody of the engineer or other officers on behalf of the board.—*The Contract Journal of London.*

THE HISTORY AND STATISTICS OF AMERICAN WATER-WORKS.

BY J. JAMES R. CROES M. AM. SOC. C. E.

(*Continued from page* 218.)

CCCXLVIII.—NEW BRITAIN.

New Britain, Connecticut, in lat. 41° 40′ N., long. 72° 48′ W., was incorporated as a borough in 1850, and as a city in 1873.

Water-works were built by the borough in 1858 after plans of McRee Swift, C. E., A. Chamberlain being the resident engineer, taking the supply from Shuttle Meadow Brook, which has a watershed of about one square mile. A stone dam forms a storage reservoir of 175 acres area, holding 700,000,000 gallons, at 175 ft. above the city. A distributing reservoir was built on a hill near the centre of the city.

Distribution was at first by wrought-iron and cement pipe, a large portion of which has been from time to time replaced by cast-iron pipe. There are 25 miles of pipe of from 12 to 4-in. diameter, with 153 fire hydrants, 1,350 taps. There are 56 meters in use. The city contributes $25 per year for each hydrant. Service pipes are of wrought iron. The population in 1880 was 13,937. The daily consumption is 3,000,000 gallons.

The works have cost $225,000 and the bonded debt is $190,000 at 6 and 7 per cent. interest.

The expenses in 1881 were: For maintenance, $3,017.80; for interest, $11,970.00; and for extensions, $2,049.26. The receipts were $16,627.39.

The works are managed by three water commissioners.

CCCXLIX.—ELMIRA.

Elmira, New York, in lat. 42° 5′ N., long. 76° 53′ W., on the Chemung River, is in a narrow valley, surrounded by hills.

Settled in 1787 by emigrants from Pennsylvania, it was incorporated as a city in 1864.

Water-works were built by a private company in 1861, after plans of Alphonse Fteley, C. E., R. M. McDowell being the resident engineer. The supply is taken by gravity from Carr's Creek, which has a water-shed of 4½ square miles. The storage reservoir of 26 acres area and 100,000,000 gallons capacity at 210 ft. above the city is formed by an earthen dam on Carr's Creek 1,100 ft. long and 36 ft. high, 10 ft. wide on top and paved with stone on the inner slope. A canal 25 ft. wide is constructed along one side of the reservoir to carry off surplus and turbid water. A 16-in. cast-iron pipe conveys the water through the dam, and thence a 12-in. wrought-iron and cement pipe extends 4,500 ft., when the water is discharged by a fountain-jet into the distributing reservoir, which is built in excavation and embankment, with its inner slopes paved, is 300 ft. square and 90 ft. above the city. Additional supply from near the Chemung River is obtained from a filter gallery 5 ft. wide and 210 ft. long, in gravel, 100 ft. from and parallel to the river. This yields about 1¼ million gallons per day. The water is pumped 90 ft. to the distributing reservoir by a Knowles pump of 3,000,000 gallons daily capacity, erected in 1880.

Distribution is by 34 miles of pipe, some of cast iron and some of wood, of from 12 to 4-in. diameter. There are 146 fire hydrants, 800 taps and 176 meters. The city pays $75 per year for each of 50 hydrants, and $50 per year for each over that number. Service pipes of galvanized iron are used.

The population in 1880 was 20,541. The daily consumption is 1,400,000 gallons.

The works have cost $345,000. Further financial statistics are not given.

A. Diven is the Superintendent.

CCCL.—CHARLOTTE, N. C.

Charlotte, North Carolina, in lat. 35° 15′ N., long. 80° 46′ W., is on slightly undulating ground, on Sugar Creek. It was settled in 1762 and incorporated as a city in 1850.

Water-works were built by a private company in 1881-2 after plans of S. E. Soper, taking the supply from a number of springs, the water from which is impounded by a dam of clay with timber heart, forming a reservoir 600 by 150 ft., and 16 ft. deep. It is 120 ft. lower than the city. The water is pumped into a stand-pipe 18 ft. in diameter and 80 ft. high, in the city.

Distribution is by 5 miles of cast-iron pipe of from 12 to 4-in. diameter, with 40 fire hydrants, 9 gates and 30 taps. The city pays $50 per year for

each hydrant. Service pipes are of lead.

The population in 1880 was 8,612. The consumption is not determined yet.

The capital stock of the company is $100,000, and the bonded debt is $100,000, at 6 per cent. interest.

Garwood Ferris is the Superintendent.

CCCLI.—PIQUA.

Piqua, Ohio, in lat. 40° 7′ N., long. 85° 13′ W., is on the Miami River. It was setled about 1800. In 1856 the Miami Hydraulic and Mining Company was formed, which purchased from the State of Ohio the Lewiston reservoir and a part of the Miami and Erie Canal and enlarged the reservoir, building an embankment 4 miles long and 25 ft. high in places. The reservoir and water power thus formed were repurchased by the State in 1858. In 1865 the Piqua Hydraulic Company was formed to utilize this power and supply water to the city, but failing to fulfill its contract, the city in 1875 purchased all its rights and constructed water-works.

The Lewiston reservoir, 46 miles from the city, at a point where several streams unite to form the Great Miami River, covers 9 square miles and furnishes available storage 14 ft. deep. The water flows in the river channel 27 miles to Port Jefferson, where a dam directs it into a feeder canal 13 miles long, to Lockington, whence the "hydraulic canal," 6 miles long, leads to the water-works. Franz Pond of 6 acres, Versailles Pond of 23 acres, and Swift Run Pond of 56 acres, also feed the hydraulic canal. There are three water powers, respectively of 20 ft., 17 ft. and 13 ft., head and fall. The pumping machinery comprises two double-acting Flanders pumps of 14-in. bore and 20-in. stroke, driven by Ross Turbine wheels, one 24 in. for domestic and one 48 in. for fire supply. The water is pumped directly into the mains with 90 lbs. fire pressure. Distribution is by 9 miles of cast-iron pipes of from 12 to 4-in. diameter, with 60 fire hydrants, 30 gates and 450 taps. For ordinary purposes, the canal, which is 35 ft. above the city, furnishes water without the intervention of the pumps. Service pipes are of galvanized iron.

The population in 1880 was 6,817. The daily consumption is 180,000 gallons.

The works have cost $80,000 besides the $300,000 paid for the canal and water rights. The bonded debt is $290,000 at 6 and 8 per cent. interest. Further financial statements are not given.

The works are managed by three trustees. J. W. King is the Secretary.

CCCLII.—SALINAS CITY.

Salinas City, California, in lat. 38° N., long. 121° 45′ W., in the Salinas Valley, was settled in 1868, and incorporated as a city in 1874.

Water-works were built by a private company in 1873, taking the supply from 3 artesian wells of depths of 80, 200 and 234 ft., and pumping the water by a 10-in. Knowles pump into three tanks, two of these containing 90,000 gallons, at 45 ft. above the city, for domestic use, and one holding 40,000 gallons, at 75 ft. elevation, for fire purposes. A second Knowles pump is provided for fire pressure.

Distribution is by 5 miles of cast-iron pipe of from 6 to 3-in. diameter, with 23 fire hydrants and 12 gates. The number of taps is not given. The city does not pay for fire-hydrant service. Wrought-iron service pipes are used. The population in 1880 was 1,600. The consumption is not given.

The capital stock of the company, which supplies both gas and water, is $60,000. There is no debt. Further financial statements are not given.

J. B. Iverson is the President, and J. P. Lauritzen, Superintendent.

CCCLIII.—WESTCHESTER, PA.

Westchester, Pennsylvania, in lat. 39° 58′ N., long. 75° 35′ W., is on an elevated ridge between Brandywine and Chester Creeks, and about two miles from each.

It was settled in 1780, and incorporated as a borough in 1789.

Water-works were built by the borough in 1841, taking the supply from Bath Springs, near the town, and pumping it through 4,800 feet of 8 and 6-in. cast-iron pipe into a reservoir.

In 1854 an additional supply was obtained from Chester Creek, 2 miles from the town, and pumped into the reservoir through 10,560 ft. of 6-in. pipe. A basin 125 ft. square is formed at the pump works, from which the water is taken in time of freshets or when the stream is muddy. When clear, the supply is taken directly from the creek. In 1881 an additional 12-in. force main was laid, and a new reservoir built, 150 by 175 ft., and 14 ft. deep. It is 91 ft. above the pumps, and from 35 to 100 ft. above the town. These works were built after plans of Isaac S. Cassin, C. E.

Distribution is by 11 miles of cast-iron pipe of from 12 to 4-in. diameter, with 90 fire hydrants and 1,000 taps. Lead service pipes are used.

The population in 1880 was 7,043. The daily consumption is 200,000 gallons.

The works have cost $100,000. The bonded debt is $95,000.

No separate account is kept of the expenses of maintenance. The receipts in 1881 were $11,000. The works are managed by a committee of three members of the Common Council, appointed by the Chief Burgess.

J. B. Wood is the Chief Burgess, and Charles Henry the Superintendent.

[TO BE CONTINUED.]

The receipt of statistics, as follows, is acknowledged with thanks: From A. Diver, Superintendent, statistics and water rates of the Elmira (N. Y.) water-works. From J. W. King, Secretary, statistics and report of water-works of Piqua, Ohio. From W. W. Flemming, Attorney, statistics and water rates of the water-works of Charlotte, N. C. From J. B. Iverson, President, statistics and water rates of the water-works of Salinas City, Cal. From the Water Commissioners, 25th annual report of water-works of New Britain, Conn. From the Water Commissioners, report of the Holyoke (Mass.) water-works for 1881. From R. J. Brough, City Engineer, report of Toronto water-works for 1881.

Letters to Washington, Cal., and San Quentin, Cal., having been returned unopened, it is supposed that there are no water-works at those places.

RICHMOND, VA., WATER-WORKS.

The new water-works of Richmond, Va., were officially opened on Thursday, June 29. From the account in the *Richmond Dispatch* we quote the following description of the works and the ceremonies attending their opening.

The new works are located on the north or bluff bank of the canal at the Three-Mile locks, which are—or rather were, for they are things of the past—three miles from the basin and about two miles from the northern limits of the city. The building which shelters the pumps and wheels is of undressed granite. There are two stories, each of lofty pitch. On the first are the wheels, pumps and all the machinery. The second is to be a grand pavilion. Small spaces on the two floors will be cut off for offices and workshops.

The building is a handsome one.

The wheels are novel. They are vertical turbine. There are three of them, and to each are attached three pumps. The water has a 20-ft. fall, and the works will have a real working capacity of 12,000,000 gallons *per diem*, all of which will have to be lifted to the reservoir, some 4,000 ft. distant, and up a height of 175 ft. These pumps were planned by Mr. C. A. Smith, of St. Louis, and were made by H. A. Ramsay, of Baltimore. In 1880 the city offered $1,000 in prizes for the best three water-works' plans offered. Mr. Smith's was accepted. Colonel Cutshaw has superintended all of the engineering, including the construction of the conduit.

THE WATER-POWER

comes into the conduit from James River at Bosher's dam, or the Nine-Mile locks. The old canal—displaced by the railroad built upon the tow-path—was not sufficient. For the whole distance, six miles, it had to be deepened, widened and straightened, and oftentimes through beds of solid granite. That was a great and costly work, but a necessary one. The city now has all the water-power it will need for years and years to come, and it is believed that it will be little affected by droughts and freshets. The old works were affected by both.

However, the big steam-pump is at hand at the new works ready for all such emergencies. It was built by H. R. Worthington, exhibited at the Philadelphia Centennial in 1876, and bought and erected by the city during the great drought of 1881. It can furnish 6,000,000 gallons per day, which is nearly as much as we now use.

MOST OF THE PROPERTY

on which these works were constructed was acquired by the city from the James River and Kanawha Company, but additional tracts were bought from other parties for building and other purposes, and now we own near 200 acres between the canal and Main street, the whole peculiarly well situated for a public park, and is now being put to that use. So we will not only get new water-works, but out of the water-works appropriation a fine park—a thing we would not soon have gotten otherwise.

At 11 o'clock A. M. the two branches of the City Council and most of the heads of department of the city government left the Alleghany railroad depot on a special train kindly provided by General-Manager Axtell, and under the charge of Captain James Duval. The train stopped a little while at the old pump-house and then went direct to the Nine-Mile locks. There the party inspected Bosher's dam and work done there to enlarge the feeder of the canal. The water had been turned on the night before, and was flowing through the gates in muddy turbulence. From the Nine-Mile locks to the Three-Mile locks the whole line is a record of skillful engineering, hard work, and large expenditure of money.

The object has been to get plenty of power; plenty not only for ordinary times, but for reasons of drought, like that of last summer, and it is believed that that has been accomplished.

Arrived at the new pump-house, the party entered by the western door. They found the wheels and pumps in place and all right, but a good deal of the finishing work yet to be done.

Mr. Keiley having assembled the party about him, expressed for all present and for the larger community whom they represented the delight which the completion of the works afforded. It gave him pleasure, he said, to state as a circumstance somewhat novel in municipal experience that all the work had been done within the first estimate, and that the $350,000 appropriated had been sufficient. He complimented Mr. Charles T. Davis, the chairman of the Committee on Water, for the prudence, patience, zeal and ability which had characterized his administration.

It was now (at 1:05) announced that the pumps were ready to be started. Mr. Davis turned the water on Wheel No. 1; Mr. Keiley on No. 2; and Mr. James Hayes on No. 3, and without hitch or "hesitation" the three great wheels commenced to revolve, the nine pumps were set to work and water at the rate of 12,000,000 gallons *per diem* commenced to go up hill through the pipes to the reservoir.

A collation was then served, after which Mr. Davis, as chairman of the committee, read a statement giving a history of the difficulties encountered and overcome in the building of these works, and expressing his pleasure that as he had introduced the first resolution in relation to the new reservoir, he could announce, as he was about to retire from the Council, that the new works are completed.

In response to calls, speeches were then made by Messrs. A. M. Keiley, Henry G. Cannon, Maxwell T. Clarke, W. H. Williams, J. Taylor Ellyson, W. H. Scott and G. Watt Taylor, in which there were liberal acknowledgements of the city's indebtedness to Mr. Davis and to his committee, and to Col. Cutshaw and his assistants.

About 3 o'clock the proceedings of the day were brought to a close, and the party returned to the city.

Among the gentlemen who were present were J. James R. Croes, civil engineer, New York, and Colonel Warburton, late an engineer officer in the British service.

It is not stated above, but is an important fact not to pass unnoticed, that the water used in turning the water-works wheels flows into the canal below the Three-Mile locks, and comes on to Richmond to turn the wheels of the Tredegar, the Gallego and other mills.

GROWTH OF RAILWAYS.

The *Railway Age*, giving a summary of the railroad building for the first six months of 1882, says: "The totals are astonishing. While only one-half of the year is gone, and that including the several winter and spring months, when the work of construction, particularly in the Northern States, is generally not even commenced, and, while there has been a great cry about overdoing railway building, and many predictions made of impending financial disaster, we find that track has been laid on at least 179 lines, in 37 States and Territories, adding a mileage of main track aggregating no less than 4,990, or, in round numbers, 5,000 miles. It must be remembered that those figures show only the main track, and do not include sidings and second, third, and fourth tracks, of which hundreds of miles have been laid. How extraordinary has been the work of the past season in comparison with its predecessors may be seen by the fact that while it shows nearly 5,000 miles of new road the aggregate reported for the same period last year was only a little over 2,000 miles, and during the same period of no previous year has it equaled even that amount. In all of the Western and Southern States and Territories railway building is being actively pushed, and an examination of the map will show that, except in a few cases, where parallel or competing roads are being built, there is ample room and need for all of these lines, and that many more even must be built before the necessities of the country are supplied. With the present outlook we see no danger of excessive railway building this year. The total railway mileage of the United States is now more than 107,000 miles."

THE WEST SHORE ROAD.—The *Springfield (Mass.) Republican* says: Work on the West Shore railroad, which skirts the right bank of the Hudson, and in which D. D. Warren of this city is one of the heaviest contractors, is being rapidly pushed just now, and it affords entertainment for all tourists on the river. The management paid Mr. Warren $87,000 last month and the work for this month will probably call forth a larger sum.

ENGINEERING NEWS

AND

AMERICAN CONTRACT JOURNAL.

Tribune Building, New York City.

GEO. H. FROST.....EDITOR AND PROPRIETOR.

S. D. V. BURR.....ASSOCIATE EDITOR.

SATURDAY, JULY 8, 1882.

EDITORIAL ANNOUNCEMENTS.

Terms of Subscription.—To the United States and Canada, $4 per annum, including postage; all parts of Europe, $5, payable in advance. Remittances at the risk of the subscriber, unless made by registered letter or by draft, check or P. O. order, payable to GEO. H. FROST.

Terms of Advertising.—One inch, 12 lines, one insertion, $2; one month, $6.50; three months, $17; six months, $30; one year, $50. Special rate for large space and long time will be given on application. Advertisements inserted for less than three months, payable in advance; for longer time, payable quarterly.

Articles for Publication in the current number should be received at the office of publication not later than Thursday morning, and advertisements not later than Friday noon.

Correspondence upon subjects which naturally belongs to the province of this journal is solicited.

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THE new issues in Van Nostrand's Science Series, will be one on "Railroad Economics," and another on "Wrought Iron Bridge Members," both by Prof. S. W. Robinson, of the State University of Ohio, and a third one, of "Pocket Logarithms" (4 *places*).

A NEW architectural volume recently issued deals with "Interiors and Interior Details," and covers, in fifty-two large quarto plates, a large number of original designs of Halls, Staircases, Parlors, Libraries, Dining Rooms, etc. Together with special designs for Low Cost, Medium and Elaborate Wood Mantels, Sideboards, Furniture, Wood Ceilings, Doors, Door and Window Trims, Wainscots, Bank, Office, and Store Fittings, in Perspective, Elevation and Detail, making a valuable series of Suggestions for Architects and Architectural Designers. The price of this volume is $7.50.

THE JOURNAL OF THE ASSOCIATION OF ENGINEERING SOCIETIES for April is received. Its contents are a Theorem of Statics, with some Graphical Applications, by Prof. Chas. A. Smith, Washington University, St. Louis. The Best System for Transit Work, by G. A. M. Liljencrantz, C. E., Chicago. Changing the Gauge of Railroads while in Operation by H. C. Thompson, C. E., Cleveland, O. Tribute to the Memory of A. L. Holley by J. F. Holloway, Cleveland. Proceedings of Engineers Societies in Boston, Chicago and Cleveland. The price of the Journal is 30 cents per number and copies can be had by addressing H. G. Prout, 12 Barclay St., N. Y. City.

THE MEXICAN CENTRAL AT PASO DEL NORTE.

From a correspondent in Paso del Norte we have received several communications containing interesting information concerning the work now being done, and that contemplated. On May 5 the grade of the Mexican Central Railway had been virtually completed to the city of Chihuahua, a distance of 224 miles south, and track had been laid on 157 miles of road; while the contractors were moving on to the first 50 miles south of Chihuahua.

On May 4, the road was opened for business from Paso del Norte to Gallego, 140 miles south, one regular passenger train being run each way daily, also one material train and one freight, besides various specials and extras. The letter states that it begins to look quite business-like. There were at that time six coaches and two baggage-cars borrowed from the Atchison, Topeka & Santa Fé Company, for temporary use until the cars belonging to the Central arrived, several of which were then on the road.

The passenger depot and general office building is of *adobe* and is nearly finished. The plan is that of a hollow square, with a *plazzita* or court in the center, in which there will be two fountains. The long side is 280 feet, parallel to the track; the other side is 186 feet in length. "It will contain some thirty rooms, baggage, ticket-office, lunch-rooms and general offices, viz.: General superintendent office and private office, superintendent of telegraph, superintendent of transportation, cashier's office. The chief engineer will have five rooms." The train dispatcher will occupy a room in the second story, over the arched entrance to the court, furnished with bay window, giving him uninterrupted views both up and down the track, and high enough to be above all obstructions. With the exception of the second story the building is strictly "Mexican in design, and will, with its modern improvement in the interior, be a pleasant change to the weary eye of the American traveler, from the uniform regulation depots of the A., T. & S. F., and the S. P. & T. & P. R. R.'s over the river; something new and interesting to those who may be compelled to wait an hour or two for custom house inspections of baggage, etc."

In regard to other improvements now in progress we quote as follows: "Round-house to accommodate twelve engines is now being commenced. Freight house is nearly completed. Machine shops will soon be started, and I will guarantee that in one year longer Mexicans from the interior, who came here to the bull-fights in December last, would not recognize that portion of Paso del Norte in the vicinity of the railroad grounds. In fact, the advent of a railroad in this ancient town has wrought wonderful changes in all directions. The old merchants who one year ago had solid doors and blinds, now have *modern glass* doors and windows to their stores, and some even became so very extravagant lately as to *drive* wells and have force pumps and hose in front of their stores to keep down the dust."

Another letter received but a short time since states that the depot is progressing very well, considering that all mill work comes from Chicago. It is partly under roof, and all the walls are done. The round house is under way, and will also be of *adobe* with stone foundations. Messrs. Lantry & Burr of Topeka, Kansas, are doing the mason and adobe work.

Regular trains are now run to Laguna, a distance of 165 miles, where stages connect with Chihuahua. By leaving Paso del Norte at 10 o'clock, A. M., the passenger can breakfast at Chihuahua the next morning. Locations have almost been completed to the Durango line.

El Paso on the Texas side is growing rapidly and will, no doubt, make a thriving town, having four roads—the A. T. & S. F., the S. P. R. R., the T. P. R. R. and the M. C. R. R., and one prospective road, the E. P. & W. O. R. R., a narrow gauge proposed to run to White Oak mining district north.

It is stated that enterprise in the town (El Paso) is slow, as it is entirely in the hands of Mexicans, foreigners being unable to *own* property within a belt of 60 miles from the border.

LITERATURE.

House Drainage and Sanitary Plumbing, by WM. PAUL GERHARD, *Civil and Sanitary Engineer, Newport, R. I.* Reprinted from Fourth Annual Report of the State Board of Health of Rhode Island, 1882.

Mr. Gerhard has made a very complete and concise digest of the theory and practice of plumbing and drain laying. No composition could well be clearer, more explicit, or better illustrated, and it is no detraction to say that it is far above the level of the public understanding. It would require at least an amateur knowledge of house-drainage to follow the reasoning, and we can especially commend it to the amateurs as a safe corrective of much of the nonsense imbibed by that class of sanitarians. It would be a good idea for Mr. Gerhard, or the Rhode Island State Board of Health to publish a health tract made up of deductions from this pamphlet, without the arguments. The public desire to be told the right thing to do with very few words, and in an authoritative way; and this is just what health boards are afraid to do, for fear they will advertise or antagonize business interests. Wide publicity should be given to the statements about cowls or ventilators on pages 24 and 25, and one plumbing humbug exposed. Householders should know that they are unnecessary and useless on the tops of ventilating pipes, "the committee of the Sanitary Institute of Great Britain having found by a series of experiments that no exhaust cowl submitted to them for trial caused a more rapid current than prevails in an open pipe." In fact they are worse than useless, for in cold weather they frequently cause the closing of the pipe by ice, at the roof line, by the freezing of the moisture condensed by contact with the cowl. Another valuable point is made on page 52, where the public are advised against contract work in plumbing; and we have reason to believe that it is now quite common to have plumbing work done on commission. To expect good contract work in plumbing, in the light of experience, is simply preposterous. One reason for this state of affairs is that plumbing establishments are universally small and irresponsible concerns; but the best and chief reason for the existence of so much unsatisfactory plumbing work is not so much a lack of conscience on the part of the plumbers (although it may well be doubted if they have any), or of knowledge of correct sanitary theories (for they are pushed at them without end), as the fact that the materials provided for the trade are unsuitable for the purpose. In no vital feature of house construction is there such a lack of scientific, or rather common, sense adoption of proper mechanical expedients. The sanitary profession has been called into being to protect the world against the plumber; after a dozen years or so they have succeeded in muzzling him, so to speak; what ought to be done, and what progress is leading us to, is to abolish him and his pipes altogether. It is not creditable to the mechanical ability of sanitary engineers that they have not succeeded in constructing absolutely and permanently gas and water tight conduits from the water-closet to the sewer, and it is still less creditable to their enterprise that they have not considered the expediency of founding an entirely new system of materials.

That Mr. Gerhard himself has doubts of the ground he stands upon is suggested by a remark on page 39: "If we could have ideal sewers, house drains and soil pipes * * * * * * * *;" and he is hardly to be blamed for the contradiction in the first paragraph of the pamphlet where he says: "It is the purpose of this paper * * * to establish rules * * * which, if carefully observed, will secure * * * work * * * of a positively safe character." That is *positively* safe *if* the work is done perfectly, *if* the joints are all tight, *if* the building does not settle, *if* the floors do not shrink, *if* carpenters do not drive nails into

lead pipes, *if* the iron soil pipe is not cracked, *if* it is not too thin, *if* it has been properly tested, and *if* the work is carefully watched, properly superintended, and inspected forever periodically, etc., etc.

Would it not be more creditable to the profession, not to say more satisfactory to the public, to construct the *ideal* sewer and house drain, instead of having all this bother and nightmare?

THE RENSSELAER POLYTECHEIC INSTITUTE.

At the recent annual meeting of the Alumni of this institution, the chairman of the Committee on Endowment announced that subscriptions had been received from graduates to the amount of $25,000. As the work is but fairly inaugurated, all were greatly encouraged by the success so far attained.

The *graduates* have undertaken to raise the sum of $100,000; but it is not proposed that the movement shall stop there; it contemplates, eventually, the establishment and endowment of new professorships, and the enlargement of the facilities for study, so as to cover the latest developments in practical science and engineering.

The Institute has always maintained the highest standard of requirements from its graduates; and as an acknowledgment of faithful work in the past her sons now propose to aid her to maintain the enviable position she has held so long among the technical schools of the country.

OBITUARY.

CHARLTON B. KID was born in Philadelphia in the year 1836, and died in this city on the morning of Sunday, May 28 last, at the age of 46 years.

Mr. Kid entered the Engineer Corps of the United States Navy May 21, 1857, as Third Assistant, and in July of the same year he was ordered to duty on the United States steamer Merrimac. Mr. Albert Stimus, who distinguished himself in building, and in operating the iron-clad Monitor in the engagament with the Merrimac at Fortress Monroe, was Mr. Kid's chief engineer on his first cruise in the navy, and always spoke of him in the highest terms. In August, 1859, he was promoted to the position of Second Assistant, and in February of the following year was detached from the Merrimac, ordered to the United States steamer Niagara in April, and was attached to her while employed in laying the first telegraph cable between Europe and America. He was highly complimented by his chief engineer for many suggestions regarding the arrangement of the telegraph machinery. In February, 1862, he was examined and promoted to first assistant engineer, and during the same month ordered to the Rhode Island. This vessel was employed to supply others engaged in blockade duty, and was constantly in service, the voyage extending from New York to Galveston. To the ability and untiring energy of Mr. Kid was due the successful duty performed by the vessel. In June, 1862, he was ordered to the Powhatan, but Congress having appropriated a large sum of money to enable the Navy Department to experiment with various kinds of machinery, Mr. Sherwood, the Chief of the Bureau of steam engineering, selected Mr. Kid as the best qualified person to conduct these trials. At the time Messrs. Dickerson and Sherwood were disputing as to the value of expansion of steam and the type of valve gear to be employed, a board of eminent engineers was organized, and machinery erected on the grounds of the Novelty Iron Works of this City. Mr. Kid arranged all the apparatus and organized the plan of conducting the experiments. The calculations and deductions were all made by him and have since been published and largely copied in engineering works. In December, 1867, Mr. Kid resigned from the navy. During his service he earned the reputation of being a man devoted to his duty and profession, singularly modest in his nature, very gentle in his judgment of others, a thoughtful student of much culture and sound reasoning. In commercial life he stood very high for his faithful attention to engagements and his inherent honesty.

About eleven years ago Mr. Kid accepted the position of Superintendent of Section and Assistant Engineer Mechanical of the Dock Department of this city. He had charge of all the machinery in the department, and his long experience and thorough knowledge of the theory and practice of every branch of construction with which he was called into contact, rendered him extremely valuable to the service, while his courteous demeanor endeared him to his associates. At the first meeting of the Board of Docks after his death the following communication was received from the Engineer-in-Chief:

NEW YORK, May 31, 1882.

TO THE BOARD OF DOCKS:

GENTLEMEN: It is with very great regret that I have to report that Mr. Charlton B. Kid, Assistant Engineer and Superintendent of Section of this department died on the 28th inst.

I have been associated with Mr. Kid during all the time I have been in the service of this department (nearly seven years) and I wish to bear my testimony to his very faithful and valuable service during all that time.

Mr. Kid was a man of ability in his profession, of sterling integrity, devoted to his work, careful and correct in all he did, affable in manner and a general favorite with all who came in contact with him, and his long service in the department (nearly eleven years) had given him a familiarity with its affairs that it will be impossible to replace. His death is a severe loss, both personally and officially, to myself and all his associates.

Very respectfully, your obedient servant,
G. S. GREENE, JR., Engineer-in-Chief.

The following preamble and resolutions were unanimously adopted by the Board:

Whereas, The Engineer-in-Chief has this day reported the decease in this city, on the 28th instant, of Charlton B. Kid, Superintendent of Section and Assistant-Engineer Mechanical; and,

Whereas, The services performed by the late Charlton B. Kid, in the several positions which he has, from time to time, filled in the Department of Docks, have been of the highest order and exceedingly gratifying to the Board of Commissioners, and at all times in the interest and to the credit and welfare of the city; therefore, be it

Resolved, That the Board of Commissioners of Docks have learned with great regret of the decease of Charlton B. Kid, Superintendent of Section and Assistant-Engineer Mechanical, and take this method and opportunity of recording its high appreciation of the faithful services rendered the Department during the many years of his connection therewith.

Resolved, That this Board express its sincere sympathy with the family of the deceased at the irreparable loss they have sustained, and, as a mark of respect, attend the funeral services on the occasion thereof.

Resolved, That the foregoing preambles and resolutions be inserted in full in the minutes of this Board, and a copy thereof be transmitted to the family of the deceased.

PERSONAL.

C. S. DWIGHT has been re-elected Chief-Engineer of the Chester & Lenoir Railroad.

CADET ENGINEERS CHAS. G. TALCOTT, GEO. R. SALISBURY and GEO. E. BARD have been promoted to Assistant Engineers, from the 20th June.

M. RECLUS, chief engineer of the Panama Canal arrived in this city on Monday from Aspinwall, quite prostrated with one of the diseases of the isthmus. He is on his way to Europe.

ENGINEER CORPS PROMOTION.—The retirements of army officers, under the compulsory retirement clause, causes the following promotions in the Engineer Corps: Major O. M. POE, of Gen. SHERMAN'S staff, and Major DAVID C. HOUSTON, to be lieutenant colonels; Captains WM. LUDLOW and WM. A. JONES to be majors.

COL. W. R. HYDE, a civil engineer formerly in the employ of the Central Pacific Company, died recently at Castor, Idaho. Of late years he had given his attention principally to mining. Col. Hyde was a member of the American Society of Civil Engineers, and a life-member of the California Academy of Sciences.

The copartnership heretofore existing between GEORGE C. BELL, S. J. FIELDS and JAMES S. METCALFE, under the firm name of the Niagara Bridge Works, of Buffalo, has been dissolved. GEORGE C. BELL purchasing the interest of Mr. METCALFE. The accounts of the late firm will be settled and the business continued under the same name by GEORGE C. BELL and S. J. FIELDS.

MR. ASHBEL WELCH, President of the American Society of Civil Engineers, and one of the oldest and most respected engineers in this country, has been appointed by the Governor of New Jersey a member of the commission which is to examine and report on the available water supplies of the State, and the best method for preserving and utilizing them, with especial reference to the supply of the cities of the State.

MR. W. R. GARRISON died at Long Branch, July 1, from injuries received in the railroad accident near that place a few days before. He was a son of Commodore C. K. GARRISON, and was, from early age, interested in his father's railroad plans and properties. He had been a director and President of the Missouri Pacific, director of the New York City & Northern, President of the Metropalitan Elevated and a director of the Manhattan Company. He was largely interested in the elevated roads in New York on his own account, having been connected with them almost from the beginning.

Mr. NICHOLAS H. DECKER, an old and well-known contractor, committed suicide by throwing himself before a heavy wagon in Johnstown, N. Y., June 24. He had a stroke of paralysis a few months ago, which seriously affected his mind. Mr. DECKER had been engaged in many important works. His last contract was the extension of the third and fourth tracks of the New York Central from Rochester to Buffalo. He had many contracts on the New York Central, and had built parts of the Worcester & Nashua, the Providence & Worcester, the Lake Shore, the Staten Island, and other roads.

RECENT INVENTIONS.

NOVEL RAILROAD TIME SIGNAL.

This novel railway signal consists of a vertically moving signal slide carrying a pointer moving over an exposed scale. A rod is connected to and extends upwardly from the slide, and has a feed movement for drawing said slide upwardly. Combined with these devices is an electro-magnet and generator, an armature with an automatic make and brake, a contact-maker or circuit between the battery or generator and magnet, and a tripping device connected to the feed movement, whereby a passing train will cause the signal to be dropped, closing the circuit on the magnet, thereby causing the armature to be vibrated, the feed move to be actuated, the slide to be raised and the time since the train passed to be indicated.

RAILROAD CROSS-TIE.

This improved tie is made of iron in one piece and is composed of a flat horizontal base-plate cut out in its middle portion and a vertical web extending the entire length of the base and terminating at the ends, with boxes adapted to receive wooden blocks, on which are secured the rails by bolts passing through the box and wooden block.

NEW METHOD OF PROPELLING VESSELS.

This construction embodies a reservoir and pipes on board a steamship, the pipes being run fore and aft and provided at their ends with branch pipes, and then approaching each other, so that currents of steam and water escaping from said branch pipes will impinge upon each other, to give motion to the boat.

PILE FOR USE IN THE CONSTRUCTION OF WHARVES, ETC.

This novel pile consists of a hollow central metal, and wood end sections, the lower one of the latter having an orifice connecting with the chamber in the metal section. Ferrules on the end of the metal section receive the ends of the wooden sections, which are secured by bolts having split heads to receive brace-rods.

YIELDING AND BUOYANT PILE BREAK-WATER.

Another similar invention by the same party comprises a break-water constructed from single

piles hinged to a water-bed anchorage and grouped together in sections, each section being connected to the next by chains, and each pile of a group connected to its adjacent one by a link near its top.

NEW PROCESS OF UTILIZING EXHAUST STEAM.

This process of utilizing exhaust steam consists in forcing the exhaust steam of an engine into a tank of water of high temperature by a jet of live steam, then forcing the steam into a superheater from said tank to be revivified, and there mixed with a jet of air from a pump; then passing it into the steam receiver, when it is in condition to be conveyed to the engine.

APPARATUS FOR SUPPLYING STEAM IN CITIES.

This invention consists of a steam generator, with a high and lower pressure steam-main, combined with a pipe conveying steam from the high pressure main to an engine, a pipe to convey exhaust steam from the engine to the lower pressure main, and a pipe to convey exhaust steam from the exhaust main to the place of use.

WASHINGTON, D. C. F. B. BROCK.

CORRESPONDENCE.

THE METRIC SYSTEM.

BOSTON, July 1, 1882.

EDITOR ENGINEERING NEWS:

The International Committee of Weights and Measures, at its session of Oct. 2, 1879, unanimously adopted the following resolutions:

1. "The International Committee of Weights and Measures adopts, for its publication and its official use, the following system of abbreviative signs for the metric weights and measures."

2. "The International Committee charges its Bureau to bring, by circulars, this system of abbreviative signs of the metric weights and measures to the knowledge of the Governments of the High Powers contracting (for the support of the International Bureau of Weights and Measures), and to recommend them to favor, by appropriate measure, its general introduction in their respective countries." (*Procès-verbaux des séances de* 1876, *page* 42.)

This system of abbreviations, which therefore has an international significance, was printed in ENGINEERING NEWS of April 8, 1882.

Just one year subsequently, at the session of Oct. 2, 1880, the International Committee of Weights and Measures unanimously adopted resolutions vigorously defining the *liter* for scientific purposes, and adding two new denominations, with their abbreviations, for expressing the minute quantities of volume and weight frequently required in scientific work.

The resolution defining the *liter* is as follows:

"The International Committee of Weights and Measures adopts, for its publications and for its official use, the word *liter* to express the volume of one kilogram of pure water at its maximum density. The thousandth part of a liter, that is to say, the volume of one gram of pure water at its maximum density, will be designated by the word *milliliter*, and by the sign *ml*. The thousandth part of the milliliter, namely, the volume of a milligram of pure water at its maximum density, will be designated by the word *microliter*, and its sign will be the letter λ." (*Procès-verbaux des séances de* 1880, *page* 30.)

The use of the liter in this sense was thus explained:

"All volumes determined by hydro static weighings will consequently be expressed in *liters*, instead of of *cubic decimeters*, in *milliliters*, instead of *cubic centimeters*, and in *microliters*, instead of *cubic millimeters*." (*Idem*, *page* 29.)

The adoption of the turn *microliter* and its symbol λ to designate the thousandth part of the *milliliter* is in conformity with the practice previously adopted in respect to the *meter*, by which the word *micron* and its symbol μ are used to represent the thousandth part of the *millimeter*.

The symmetry of this notation was completed by another resolution, which announces, "the word *microgram* and the use of its symbol γ, to indicate the thousandth part of the *milligram*." (*Idem*, *page* 56.) C. H. SWAN.

RAILROAD ECONOMICS.*

BY S. W. ROBINSON, C. E., OF THE OHIO STATE UNIVERSITY, MEMBER OF THE BOARD OF INSPECTORS UNDER THE HON. H. SABINE, COMMISSIONER OF RAILROADS AND TELEGRAPHS.

IRON BRIDGES.

The prevailing form of iron bridge is the Pratt truss for long spans, and for short the plate girder. The change from one form to the other occurs usually at lengths between 60 and 100 feet. These statements apply more definitely to recent practice than former. The older iron bridges are very promiscuous, both as regards form and manner of putting together. Some of the first iron bridges in the State were Howe trusses, one of which went down in the Ashtabula disaster. But in place of the latter we now find what is probably the strongest iron Pratt truss in the State, so that people need not now go around Ashtabula to avoid a second catastrophe.

The parts of truss bridges were formerly united in various ways, sometimes by bolts, notches, and locks, and often by riveting in place. But at present the method by pins and eyes prevails, especially for the longer trusses. In upper chords, however, though the tie rods are usually attached by pins, yet for increasing the rigidity they are made continuous by riveting on splice pieces extending past the pin-holes. The forms of parts of bridges, as well as the methods of joining, are almost as though stereotyped. Thus the "eye-bar" is an article of manufacture, and is used in all parts of bridges except upper chords and struts or columns.

Upper chords and end posts are most frequently made of two channel bars, 12 to 18 inches apart, with webs vertical. They are joined on top by a longitudinal plate extending the whole length and rivited to the flanges, while the bottom side is latticed or "laced." "Web" members serving as struts are most frequently composed of two channel bars at a distance apart, and connected by diagonal lattice slats riveted on. Sometimes, however, the two channel bars are rivited by their webs to the flanges of an I-beam. Formerly Phœnix, Keystone, box, and other columns, nearly or quite closed, were much in use, but they appear to have given place almost entirely to such open columns as above mentioned, simply from the necessity experience has developed of painting every inch of surface in iron bridges.

Most engineers require forms such that a paint brush can touch every part, either inside or out. The advantage of this is seen from the fact above mentioned of the rusting of truss rods and of tin roofs from moisture and smoke. The statement also, which has come to my notice, that tons of rust have been removed from tubular bridges, is in point.

Floor-beams, made by riveting four angle-bars upon the edge of a plate,—two upon each edge at opposite sides,—are the most common. The section approaches that of the I-beam. Plates are often riveted on top and bottom, part of the length, to increase the strength at the middle part where the moment of strain is greatest. These beams are most frequently suspended from the pins of the trusses by inverted "∩" bolts. But when there is scant room below a bridge, for water-way or otherwise, they are in some cases rivited to the vertical struts.

The stringers are most frequently of rolled I-beams.

The lateral stiffening is much better attended to in iron bridges than in wooden ones. The lateral ties not only vary in size, from end to middle, but differ in size according to span, width, etc. There is generally a lateral system at both the bottom and top chords.

Plate girders are usually formed by riveting angle-bars to the sides of the webs, top and bottom, then across these a flange. The latter is increased by additional "lifts" laid on in the middle portion. These plate girders are usually of uniform depth, though some have been met in which the upper flange or chord was arched so as to nearly join the lower chord at the ends. Vertical stays of angle-bars are riveted to the web throughout these girders, but nearest together at the ends; their object being to prevent the buckling of the webs. Most usually the two girders of a bridge are joined by riveting to the floor-beams, so that all forms a connected system. An angle-plate then is set between the floor-beams and girders, to prevent the latter from swaying or careening.

But on some roads many of the plate girders have wooden floor-beams; the latter sometimes resting directly upon the lower flanges and sometimes on angle-bars rivited to the girders. A neat and serviceable small bridge, where there is sufficient water-way, consists of plate girders, about 10 feet apart, with lateral and sway bracings, and upon which are mounted the wooden floor-beams. This plan is carried down to I-beam girders of 10 feet span or less.

In a few instances weak iron bridges have been strengthened by springing iron arched ribs from the abutments, composed of channel iron, and securing the same to the trusses at a suitable number of points.

At the present day many good iron bridges are found to be too weak. This is due not to any engineering defect, but to the growth in weight of freight loads and rolling stock. We now find 60-ton locomotives where formerly there were 40; and 20-ton loads per car where there were 10. Hence bridges designed to a strain of 10,000 pounds per square inch of iron section, as due to the former loads, must now stand 15,000, or perhaps more. This is unfortunate since an iron bridge is so difficult to strengthen in a satisfactory manner, and so difficult for the road-men to get renewed.

Expansion and contraction of iron bridges is provided for in supporting one end on rollers. In short spans, however, rollers are dispensed with, and the bearing plates slide. Often the observed expansion reported by bridge attendants does not account for the whole variation of length, even where rollers are in use. It is believed by some that the rolling resistance under so much weight is so great as to spring the piers where piers are tall. Thus it appears that strains, due to constrained expansion, may be too great upon chords to be ignored in calculating total strains.

STRAINS UNDER MAXIMUM LOADS.

In proportioning the parts of bridges for resisting their strains, a great variety of detail exists in the present practice. We find no "live" bridge engineer of to-day adopting a fixed maximum load per foot for all spans, even for the same road and the same trains; neither do we find the same fractional part of the ultimate or elastic resistance of the iron adopted for the allowable strain for all parts of any one bridge. The factor of safety is "a thing that was" to such an engineer.

In the first place the quality of the iron is allowed to differ for different parts of bridges. Tension members are never made of anything but "double refined" iron, that is, iron that has been double rolled. This consists of taking "muck bars" (the result of first rolling from puddle blooms), cutting and piling them, reheating to a welding heat, rolling into bars, then cutting, piling, and reheating again, when they are rolled to the needed sizes. Compression pieces are single refined, in which the last piling and rolling above described is omitted. Channel bars of columns and upper chords are thus treated.

A fair quality of double refined iron in bars should have a tensile strength of 50,000 pounds per square inch; an elastic limit of 26,000 to 30,000 pounds per square inch; should stretch 15 per cent. in 8 inches; bend 180° around a cylinder of diameter equal its thickness without fracture; and when kicked and broken should show a fibrous structure. Such iron in the regular truss tension members is usually allowed to be strained to 10,000 pounds per square inch for the maximum load. In some cases floor-beams are allowed 8,000 pounds only, because they are strained nearly to the maximum allowed for each passage of load. This is true of floor-beams, because the greatest load occurs when under the drivers of the locomotive. In the main truss, however, the maximum strains are only reached when the whole train is to the maximum, a condition which does not happen with every train. The ∩ shaped hangers for floor-beams are usually allowed only 5,000 to 7,000 pounds. Struts and upper chords are computed as columns, and on a supposed basis about 8,000* pounds square inch. This low value is probably partly due to the fact of single rolling for channel iron.

ASSUMED MAXIMUM LOAD.

In calculating the maximum strains there are two ways of treating the question of the maximum load. 1st. By adopting the greatest actual train weights, such as two of the heaviest locomotives, followed by a train of the heaviest loaded freight cars; then computing the strains as static effects to which results are added, for "dynamic effect," about 25 per cent. for spans of about 20 feet, 15 per cent. for spans of about 50 feet, 10 per cent. for spans of about 75 feet, and diminishing to no per cent. at spans of 100 feet and over. 2d. By assuming fictitious train weights which are uniform per foot for the span, but which are much the greatest for short spans. Thus, for some roads on this plan, the assumed load for calculating strains is 6,000 lbs. per foot for 10-feet spans, 4,000 for 40-feet spans, 3,000 for 150-feet spans and 2,500 for 500-feet spans.

This diminishing scale is to be accounted for as providing, first, for impact: the latter being greatest for short spans, because so much more quickly passed by the forward end of a train, and causing an application of load which is so sudden as to be of the nature of a blow; and, second, because short spans have the locomotive itself for the maximum load, while longer spans can only be cov-

*Extract from a paper read at the annual meeting of 1881 of the American Society of Mechanical Engineers.

* By a rational formula for columns, published by the writer since this paper was presented to the Society, it is shown that this value should be but a little over 6,000 pounds. See Van Nostrand's Eng. Mag. for June, 1882.

ered by adding to the one or two locomotives some portion of the train.

CRYSTALLIZATION OF IRON IN BRIDGES.

As regards the deterioration of iron in use by crystallizing, there are differences of opinion and too few facts. One man will present evidence of crystallization, while another will produce equally good evidence against it. It appears that data are too uncertain. When rods taken from a bridge are found to be crystalline, it is not known whether they were not so when put in. But this matter will be settled in due time, because positive data now exist as to the condition of iron in existing bridges. When the future engineer shall examine the parts of these bridges, and compare notes with the former records, we shall know how about crystallization.

STEEL BRIDGES.

We are now at the verge of a steel bridge era, several important steel bridges being already built and in process of construction. The more serious mechanical difficulty in this direction is already overcome in the existence of machinery for the manufacture of solid steel eye-bars. Steel is in every way better fitted for bridges than iron. It is less subject to deterioration, becoming more uniform in results of manufacture, has an ultimate strength of nearly double that of iron, and an elastic limit from two to three times as high. Considering the strength, it is but little, if any, more costly. This step from iron to steel is but the natural course from cast-iron up, which latter material is now entirely abandoned as a material for bridges, except for unimportant members, such as wall plates, packing pieces, etc.

SWAY BRACING.

In both wood and iron bridges "sway" bracing is universally employed in deck bridges. But such bracing is held in doubt by some, except at the ends of the bridge, where it should be especially strong. The reason given for this belief is that where one truss receives a greater strain than the other from any such cause as wind against the train, train at one side, as in double-track bridges, curved track, etc., each truss should be allowed to remain in a plane. But the sway braces preserve the cross-section, so that if one truss deflects more than the other, each truss must careen to one side to some certain corresponding extent at the mid-span, but not at the ends; because here the solid abutments prevent. This forces the chords laterally out of a straight line, causing horizontal transverse strains upon them. The eye-bars on one side of the lower chord would, under these circumstances, be strained more than those on the other side, an inequality which would disappear in the absence of sway bracing. Not only would the main trusses be effected, but the lateral bracing at top and bottom would be strained unduly, and probably higher than provided for in the oversight of this matter. The old Ashtabula bridge was an iron deck, and who can say to what extent the sway bracing was responsible in the failure of it?

Though the one consideration of greater flexibility of cross-section seems to favor the omission of sway braces, in that we thus obtain freedom from strsses in one system of bracing as due those in another system, yet it is probable that the yielding cross-section will allow the train, while under wind pressure, to be forced to a greater inclination toward the leeward, thus causing a probable greater displacement of the center of gravity of train toward the leeward truss, and increasing the strain on the latter.

VIBRATIONS AND STRAINS.

In observing the deportment of a bridge as a swift train passes over, the parts are seen to be much agitated. Tie rods will often fly about at the middle parts to a very considerable extent. This has evidently received some attention by engineers, because in a few instances tie rods at the crossing points have been found tied together apparently to stop vibrations. That all such vibratory movements cause direct strains in the vibrating parts there can be no doubt; and it is unfortunate that these vibrations cannot be predetermined so that the strains resulting from them can be calculated. Could these be accurately determined, it is probable that the practical maximum working stress for bridge iron in tension could be safely raised from 10,000 pounds per square inch to 15,000 pounds; a margin being still left between the latter figure and that for the elastic limit for indeterminate strains due to such movements as considered below.

LURCHING OF THE BRIDGE.

In some cases the whole central part of the bridge is also in an agitated condition, both vertically and horizontally. There seem to be various causes for this, such as want of perfect balance in the drive wheels and connections, error in perfect alignment of rails, especially in the vertical plane, wandering of the wheels from side to side over the 1 to 1½ inches of clearance between flanges and rails, irregularity of curves on bridges, tangent points on bridges, etc. In some cases this seems to amount to an oscillatory or vibratory movement of the whole bridge.

A BRIDGE INDICATOR.

In order to study these effects more satisfactorily, as well as the "dynamic effect" of a moving train upon a bridge, an instrument has been devised which might be called a *bridge indicator*, the object of which is to give a graphic record of the movements of a bridge as a train passes it.

TESTING AND SELECTING MATERIAL.

In the selection of material for bridges, great care is exercised by bridge companies, much greater, indeed, than is usually supposed by the mass of people who ride over their bridges. Some bridge companies make tests of the materials not specified or required by the railway companies ordering. For instance, the Detroit Bridge Company examines all the eyebars for a bridge by piling a quantity of them and passing the pin through the eyes at opposite ends simultaneously. Any bar preventing the passage of the pin is thrown out. Then the bars are individually tested to a tensile strain of 15,000 pounds per square inch, and again the pins must similarly pass. If any eyebar has stretched so as to prevent the passage of the pin it is rejected. Such a practice would discover hidden flaws, and would pay if discovering such flaws only at the rate of one in a hundred bridges. A flaw which would probably have been made known by such a test was actually discovered by the road master of the Baltimore & Ohio Railway in one of his iron bridges, and the piece had to be removed. A first-class catastrophe might have here resulted except for the keen eye of the road master. There are those who object to straining iron going into a structure, especially beyond the working load. But a test which will discover the few hidden flaws that would otherwise pass unobserved, will probably more than offset imaginary evils due to strains which, though within safe limits, are somewhat in excess of the adopted working load. Accordingly this test is believed to be a most excellent one, but of the few bridge companies conferred with in regard to it by the writer, it has been found in use only in the one instance named.

All companies do more or less testing with testing-machines, including pieces ranging from small "test specimens" to full-sized bridge members. Tests for tensile resistance are by far more plentiful than compressive, but a good number of the latter are on record including full-sized bridge-columns. It is a quite common practice, however, to test a piece taken from a large bar rather than the whole bar itself. Large bars are thus found to have a lower tensile strength than smaller rolled bars.

Testing-machine tests for tension, to meet the present demands of bridge builders and companies, must make known at least three quantities: 1st, the elastic limit; 2d, the ultimate strength: and, 3d, the percentage of total elongation of some specified portion of the original bar, usually 8 inches. In some cases the greatest reduction of section is noted, and by some this item is preferred to the percentage as above.

As regards the elastic limit, it is found not to be perfect, that is to say, some permanent elongation is alway experienced by good iron before arriving at what is usually adopted for that limit. But practically these elongations are nearly proportional to the increments of load, and extend nearly through the whole range of loading up to the so-called elastic limit. Beyond this limit, however, they rapidly increase. The point where this change takes place is noted as the elastic limit. This limit, thus found, is given a more rational showing from the fact that, if at any point within it, the strain be relieved and then restored, no further permanent elongation is experienced till after passing the previous condition of strain. At points beyond the elastic limit, however, this is not the case. An extended examination of iron specimens will verify the following facts: 1. Bars immediately from the rolls, which have not been subjected to jars or other causes of strain, will experience permanent elongation at very slight tension. This is true also of bars direct from the annealing oven, even though they had previously been subjected to violent mechanical action. In these cases there appears to be no limit of perfect elasticity. 2. A gradually applied and removed tension within the usually accepted elastic limit produces a permanent elongation, which will not be increased for like or less tensions as above stated. This is also true of compression. 3. A specimen which has been strained, as indicated in 2, will take a permanent set for a slight reversal of the strain. 4. At the point where the permanent elongations cease to be nearly proportional to the increments of load, or to the elastic elongations, we find the usually accepted elastic limit. Some of these facts can be verified by simply straining a piece of annealed wire by hand.

But the most common tests in use among bridge builders, and which are at once both invaluable and fortunately of easy application by any blacksmith, consist, 1st, of bending a bar 180° around a cylinder whose diameter equals the thickness of the bar, and which the bar must stand without fracture to be accepted; 2d, of nicking a bar on one side with a cold chisel, and bending it similarly as in 1st with the nick at the bow of the bend, when it will usually break, showing a fracture which must be fibrous and free from glistening points or faces. Very frequent use is made of these tests in the smithy workshops where waste pieces of bar ends, which have no other value except for scrap, are put to a most valuable service.

HEADS OF EYE-BARS.

In the manufacture of one very important part of iron bridges, viz., the eye-bars, a number of methods are in use. One consists of forming the heads by a separate operation and then welding them upon the bars. The weld is made close to the head without upsetting the bar near the welding point. This must certainly reduce the sectional area of the bar at points so near the weld as to be heated but not worked, because the heat cannot be taken without corroding the iron, and thus eating away a small portion. But where full-sized bars of this kind have been tested to destruction, it appears that the rupturing point is always at some intermediate part of the bar considerably removed from the head, thus proving the reduction by burning to be unprejudicial. This practical ignoring of the slightly reduced end sections appears to be due to the influence of the head. This conclusion is verified by experiments in tension on extended necks of wrought iron, the fracture always occurring at some intermediate point in the neck.

In other cases heads are formed on the bars by welding several thicknesses of iron upon the side of the bar, thus giving a sufficient body of metal to form the eye. The reduction of section, above mentioned, by fire corrosion will take place here also, but actual experiment has shown it to be without objection for reasons above given.

SHRINKAGE IN RAILWAY VALUES.

The *Financial Chronicle*, in a late issue, illustrates the immense shrinkage in the market value of railroad stock during the past twelve months, by giving a table showing that 115 corporations have lost $514,000,000, if a comparison of the highest prices of 1881 is made with the present prices of the present year, 1882. The shrinkage of some of the stocks and their percentage of decline is given as follows:

	Shrinkage	
	Per cent.	Value.
Chicago, Burlington & Quincy	55	$34,269,507
New York Central	31⅛	28,058,128
Union Pacific	24¾	15,064,953
Northern Pacific	22¾	10,092,000
" " preferred	21¾	9,044,000
Wabash	37⅞	10,280,000
" preferred	50⅝	12,380,000
Missouri, Kansas & Texas	27⅝	11,277,000
Denver & Rio Grande	61	17,787,000
Missouri Pacific	28	8,400,000
Central Pacific	17	10,076,000
Texas & Pacific	30¼	11,160,000
Oregon River and Navigation Co.	62	11,160,000
Erie	19⅛	15,100,000

An inspection of these shrinkages by investors who were so unlucky as to invest at the top of the market during the height of last year's speculative period ought to be enough to give them a fit of the blues, unless they sold out before the market declined largely.

INSTANCES OF TIDAL WAVES IN THE GREAT LAKES.

The recent Cleveland tidal wave revives speculations as to the origin of these remarkable but not unprecedented lake phenomena. One theory is that they are caused by tornadoes which only touch the earth for a few miles and then bound off into the upper air, to return again, repeating this operation until their force is spent. The fact that a dark cloud, with wind, traveled with the wave when the latter was observed at Cleveland, would seem to show that the origin of this one is to be sought in atmospheric influence. The Cleveland *Leader* gives the following *resumé* of similar phenomena in the past:—On Lake Superior, in 1789, opposite Isle Royal, there was a sudden fall of four feet in the waters. When they returned they did so with a rush, the vibration continuing for several hours. In 1834 the waters above the Sault Rapids suddenly receded, and in half an hour returned with great velocity. In August, 1845, Dr. Foster states that while in an open boat between Copper harbor and Eagle River, an enormous surge twenty feet in height and crested with foam, rolled toward the shore, succeeded by two or three swells. Dr. Foster observed repeated flows and reflows of the waters in 1847. 1848 and 1849 which preceded or followed storms on the lake. In 1851 D. D. Brockway reported, in a perfect calm, a sudden rise of one foot and three inches, and in another two and one-half feet. The Lake Superior *News* of July 17, 1855, reports extreme fluctuations between the hours of 9 in the morning and 4 in the

evening. Father Andre, in 1670, while on Green bay, reported a three feet rise, but this was accompanied by a north-wester. On April 14, 1858, the Milwaukee *Sentinel* reported a change of level in Lake Michigan of six feet. May 10, 1823, according to DeWitt Clinton, at Otter creek, on the Canada shore, a wave came in nine feet in height, and the same occurrence took place at Kettle creek, twenty miles distant. Another in 1830 reports three waves at Madison dock, Lake county, O., the first rising fifteen or twenty feet. In 1844 or 1845 a wave came into Euclid creek, fifteen feet in height, carrying everything before it. On November 15, 1845, the water at Cleveland suddenly fell two and eight-tenths feet during a high wind from the south-west. The Toledo *Blade* records a change of ten feet on December 5, 1856. On June 1, 1872, at Charlotte, which is at the mouth of the Genesee river, the water rose twenty-two inches. In May, 1855, the waters of Seneca lake exhibited a like phenomenon of continued rise and fall of sixteen and a half inches to two feet through two days. Similar agitations of the waters have been observed in Lake Geneva in Switzerland.

THE OFFICE OF COUNTY SURVEYOR.*

BY FRED HOWELL.

We, of Ohio, have been the first to inaugurate an association of surveyors. Other States are following after us, and I believe these organizations will be the means of great professional improvement, and that they will ultimately raise the office of County Surveyor to the important position it was originally intended to occupy, and I hope that every member of this association will take a deep interest in making our meetings both interesting and instructive, so that the standard of our profession may be raised, and the people benefitted thereby.

There have been some arguments used against perpetuating the office of County Surveyor, owing to the fact that candidates are the choice of some political party, and no account taken of his qualifications. This, I am not only willing to acknowledge, but am anxious to have changed, and the remedy is simple.

Make no person eligible to the office of county surveyor who has not been a practicing surveyor for some years, or who has a diploma from some college, or who has not passed an examination before some competent board, to be appointed by the Governor, or other proper authority. Then let the nominee, who is the choice of the people, hold the office.

We are thus willing that the competency of the county surveyor shall undergo a test, while at the same time the competency or ability of the other county officers is not called into question. Thus the importance of the office will be recognized.

The present laws gives the county surveyor considerable arbitrary power, and the people knowing that his work has more legal value than any other surveyors, makes it very necessary that he should be fully competent to perform his duties.

One of the difficulties the surveyor of the present day has to contend with is, not so much to make a correct survey, as to follow the lines of former surveyors, taken with incorrect instruments.

We need better instruments than are generally used. A surveyor, even if not the best in the world, can do tolerably good work if he has good instruments to work with; but I have seen some men try to run lines with instruments that I would defy the first professors of mathematics in the land to carry a straight line with.

Our laws provides that the office of county surveyor shall be supplied with stationery and all other suitable articles needful for the proper discharge of his office duties, and I have no doubt the intention of our lawmakers was to provide suitable instruments. Could we show our present legislators the ridiculousness of furnishing pens, poncils and paper to make elaborate calculations on, when the instruments used in obtaining the data for such calculations were altogether incorrect and unfit for use, I think they would soon amend the wording of the laws so that there could be no mistake as to their meaning, and that each county would be furnished a set of instruments of sufficient fineness of make to enable the County Surveyor to do practicably correct work.

Again, while the law makes the County Surveyor responsible for the correctness of his work, it says in effect that he shall not have the assistance of competent chainmen, one dollar a day being all the law allows them.

I claim that the surveyor's assistant or rear chainmen, should be as competent as the surveyor himself to carry the line and make correct measurements, and should be entitled to an adequate compensation.

I am satisfied we have the best sytem of public surveying that has yet been devised—the United States survey—but the perpetuating of that survey has been sadly neglected, and I am sorry to say some of this neglect stands charged against the County Surveyors themselves. But I believe the greater neglect has been by the people, and their representatives in our legislatures in not requiring that records should be kept of all surveys and plats, in the County Surveyor's office, thus giving a large amount of work to the incumbent of the office and making it remunerative, thereby inducing good men to strive for the position, instead of forcing them into other branches of business.

Not only should the field notes of the original surveys be kept in the office of the County Surveyor, but all subsequent surveys should be properly recorded in that office, with indices corresponding to the township and sections. The records should show for whom the work was done, at what time, and what new witnesses, if any, were taken. A record of this kind would be of the greatest importance to the people, as well as of great aid to the surveyor.

Now, if the County Surveyors have, in the past, neglected the business of keeping the records, for which I think they have sufficient excuse (no persons being very anxious to work unless they get paid for it), there is the greater reason why this state of things should cease to exist.

We must have all laws relating to the office overhauled and revised, have none but competent and honest men to fill the office, then get our legislators and people to uphold it by our showing them the difficulties of restoring lost corners, and the great amount of litigation likely to ensue from their loss, call their attention to the importance not only of preserving records of all landmarks in the office, and of the equal necessity of perpetuating the evidence of corners established by United States surveys by permanent monuments. The government marks were temporary, to last merely until the lands should be occupied, when, it was supposed, the owners would have interest enough to perpetuate them by durable monuments, instead of which the witness trees are being destroyed by the very parties whose interest should protect them. This destruction should be at once stopped.

Permanent monuments should be set at all corners of originally surveyed townships by the County Surveyor, and at the expense of the county. Indeed, all persons to whom I have spoken on the subject, seeing the difficulty of restoring those corners when lost, would be glad to have all section corners, as well, properly established and marked, and would be very willing to have the expense paid from the general tax duplicate. I would recommend that immediate steps be taken to have the laws so amended as to require every surveyor, on establishing corners, to put down something permanent that would show for itself that it was put there for a purpose, thus protecting it from removal or destruction. To further this end, the surveyor should be allowed, from the county treasury, a fair compensation for every monument so located by him.

A material very well suited for this purpose, and which could be furnished very cheap, would be vitrified pottery, similar to drain or sewer pipe, moulded in a rectangular form, with the proper letters and figures on the faces, representing township, range, and section.

All surveyors practicing within the county should be commissioned, qualified, and give bond the same as the County Surveyor, so that the people might have their choice of surveyors to do their work, and at the same time have the assurance that it was done by competent men; but all surveys should be returned to the office of County Surveyor for recording, and all surveys not so recorded should have no legal or official value.

* Read at the third annual meeting of the Association of County Surveyors of Ohio, held at Columbus, in January last.

SANITARY AND RURAL IMPROVEMENT.

Delegates from the various sanitary and rural improvement societies will hold a conference at Warwick Woodlands, Greenwood Lake, New Jersey, on July 7, 8 and 10, for the purpose of forming a national association and for discussing various topics of moment and interest. Prominent among these topics will be "Water Supply and Sewerage Problems;" "Public Parks and Tree Planting;" "The Prevention of Nuisances;" "School Hygiene and Adornment;" "Sanitary Tracts;" "Women and Household Sanitation;" "The Electric Light in Towns and Villages," and "The Causes and Prevention of Malaria." Among those expected to attend and read essays are the Hon. Erastus Brooks and Dr. Elisha Harris, of the New York State Board of Health; Dr. John S. Billings, Vice-President National Board of Health, Washington; B. G. Northrup, Secretary Connecticut Board of Education; Dr. E. M. Hunt, Secretary New Jersey State Board of Health; Col. George E. Waring, Civil Engineer, of Newport, R. I.; Franklin B. Hough, Chief of the Forestry Division of the Department of Agriculture, Washington; Mrs. Isabella Beecher Hooker, of Hartford; A. M. Bell, M. D., editor of the *Sanitarian*; Prof. Henry Morton, President Stevens Institute, Hoboken; Frederick Law Olmstead, Brookline, Mass.; J. J. R. Croes, C. E., of New York; Rudolph Hering, C. E., of Philadelphia; Dr. D. F. Lincoln, Geneva, N. Y.; Dr. Joseph H. Raymond, Health Commissioner of Brooklyn; William Paul Gerhard, C. E., of Newport; Elwyn Waller, Ph. D., New York School of Mines; Dr. T. O'C. Sloane, Ph. D.; William Rupp, F. C. S.; Warren R. Briggs, Bridgeport; M. C. Heath, M. E., New York, and Col. John Y. Culiyer, Brooklyn.

COMING SOCIAL SCIENCE MEETING.

Arrangements have been made by members of the American Social Science Association to hold their regular annual meeting at Saratoga, Sept. 4, the meeting to continue in session four days. The general sessions will be held in the evening, and department meetings in the morning. On the first evening an opening address will be made by the President, Prof. Francis Wayland, of Yale College, New Haven, Conn., and this will be followed by the annual report of the Secretary, F. B. Sanborn, of Concord, Mass. On Tuesday evening there will be addresses and reports from the Department of Education, and exercises will be observed in commemoration of the late Charles Robert Darwin, of England. On Wednesday evening the annual election of officers will take place, and an address will be delivered by Miss Clara Barton on "International Relief Associations." On Thursday evening addresses will be made by President Angell, of the Michigan University, on "The Relations between China and the United States," and by the Rev. Washington Gladden, of Springfield, Mass., on "Musical Forces." On Friday evening an address on "The Factory as an Element of Civilization," will be delivered by Carroll D. Wright, of the Massachusetts Bureau of Statistics of Labor. Papers will be read and discussed at the Department meetings in the morning. Among those announced are the following: "The School and College Curriculum of America and England," by Miss Helen Magill, P. D., of Swarthmore College, Penn.; "The Education of the Hand," by Mrs. L. E. Caswell, of Boston; "The Civilization of American Indians," by Miss Alice C. Fletcher, of Washington; "Boards of Health," by Walter Channing, of Boston; a paper on "Insanity—the Management of Chronic Inebriates and Insane Drunkards," by A. N. Blodgett, of Boston; "The Sanitary Condition of Boarding Schools," by D. F. Lincoln of Peekskill; "The Health of Criminal Women," by Eliza M. Mosher; "Professional Ethics," by Theodore Bacon, of Rochester; "Disfranchisement for Crime," by James F. Colby, of New Haven, Conn.; "The Penalties for Crime against Property," by Hamilton Andrews Hill, of Boston; "Local Self-Government in the Northwestern States," by Edward W. Bemis, of Johns Hopkins University; "The Modern Assessments of Co-operative Plan of Assessment," by George M. Sharp, of Baltimore, Md. Several reports will be made on factory and railroad labor.

FOR A COMMON PRIME MERIDIAN.

WASHINGTON, July 6.—Mr. Belmont, of New York, called up his motion in the House to-day for the reconsideration of the vote by which the House refused to order to a third reading the joint resolution authorizing the President to call an international conference to determine on and recommend for universal adoption a common prime meridian to be used in the reckoning of longitude and in the regulation of time throughout the world. The vote was reconsidered and the joint resolution read the third time and passed.

NOTES.

COST OF BUILDING A RAILROAD.

The Atlanta (Ga.) *Constitution* thus reports an interview with Major J. W. McCracken, who has charge of the building of the East Tennessee, Virginia & Georgia Company's new line from Macon to Rome:

"To start with, how long is your road?"

"It is 161 miles long with 12 miles of side-tracks—total 173 miles.

"How much did it cost to survey the line and locate it?"

"Colonel Sample and I rode over the line from May 30 to June 4. The engineer corps were filled up by July 26. We paid out to these corps just $65,000 before we had decided on our exact route."

"The route once decided on you had to buy the right of way. How much did that cost?"

"Just $85,000. Of course much of it was given to us, but we paid to agents and for the right of way $85,000."

"You had to have equipments, tents and tools, and wagons and machinery to work with—cost of this."

"About $175,000. You see we bought the very best of machines for laying track, for building

trestles, grading, etc. These are very costly. Our equipment was first-class in every respect. And much of what we have can be resold."

"Then having secured the right of way you had to go to grading. How much did that cost!"

"The grading alone cost $850,000. But we have already paid out to contractors for grading, bridges, etc., $1,500,000. The Rome extension is not finished and we will pay out nearly enough to make the total paid to contractors go up to $2,000,000."

"Time for breath! Thank you. Track once graded the next is cross-ties—cost of these?"

"They cost us laid in the track $460,000. There are 2,640 ties to the mile or 456,720 ties between Rome and Macon. This represents the number of steps a tramp must take when he walks over our roads."

"After the cross-ties comes the rails. What did these cost?"

"The rails weigh 56 lbs. to the yard. They cost in New York, $858,850. To this must be added freight from Perth Amboy to Macon, Atlanta and Rome. Say in all $900,000."

"After the rails comes the depots. What about these?"

"We have paid out $216,000 for the ground for depots, yards, etc., the most of it in Atlanta and Macon. We have contracted for 20 depots at a cost of $75,000. They are to be tasty modern wooden depots. Of course our city depots will cost much more. We have not yet arranged definitely for these."

"How about the equipment?"

"We shall use the splendid equipment of the rest of our line for this division, but to bring it up to the standard we have ordered for its quota to the general equipment 400 new coal cars. 600 box cars and 20 passenger cars, at a cost of $750,000, and 26 new engines at a cost of over $300,000."

That closes it up. Let's recapitulate; For tents, machinery, tools, etc., $175,000; for location and right of way, $150,000; for grading, bridges and trestles, $2,000,000; for cross-ties and laying them, $460,000; the rails, $900,000; depot grounds and depots, $291,000; and equipment, besides what the rest of the line contributes, $1,050,000, making a total of $4,926,000 for 173 miles. And that is what it costs to build a first-class road, as figured by one who paid out the money.

"Where was the most of this paid out?"

"In Georgia. The $2,000,000 for contractors was all paid out in Atlanta and most of it spent here. The $150,000 for survey and right of way was all paid out in Georgia. The $460,000 in cross-ties was paid along the Macon & Brunswick road for the Macon Division and along the track of the grade for the Rome Division. The $291,000 for the depots and grounds and most of the $175,000 for getting ready was spent here. Our bills for ten months with one house in Atlanta were over $75,000. We have spent about $3,000,000 for labor and material that circulated in Georgia."

NEW YORK FINANCES.

According to the monthly statement of the city debt, issued July 5 by Comptroller Campbell, the total funded debt on the last day of June was $136,041,807.59, not including $13,971,729.40 revenue bonds, issued in anticipation of taxes. The bonded debt of the annexed district above the Harlem River, which is included in this statement, is $875,500. On the last day of June the amount in the sinking fund for the redemption of the city debt was $38,384,989.21. During the month of June warrants amounting to $4,786,106.49 were drawn against the City Treasury, making a total of $22,844,258.88 since the beginning of the year. From Jan. 1 to June 30, inclusive, stocks and bonds were issued to the amount of $14,265,784.40. Of this sum, $953,500 was for public works, street openings and improvements; $465,000 was for Croton water purposes; $427,000 was for docks and slips; $160,000 was for expenses and awards of the Assessment Commission, and $12,154,100 was for current expenses of the city government.

CURIOUS PATENTS.

The thousands of patents which are filed monthly in Washington form not one of the least important signs of the restless vigor and progress which the people of America are displaying in science and mechanics. But while many of these patents are of great practical value, there are great numbers which would appear to be visionary, though perhaps ingenious, to a practical man. The "cranks" are almost as numerous as the sound, practical men in making applications to the Patent Department in the capital. Not long ago an inventor, who is now in jail on a charge of fraud connected with the Peruvian claims, applied for papers of protection in connection with a chemical composition that would absorb as much caloric as might be required and retain it for twenty-four hours. By the means of this invention he saw his way to heat cars without any chance of danger from fire, or to allow every man to carry about his own foot-warmer in his pocket. A more ingenious gentleman has recently struck upon the idea of preserving beef and mutton while the animals to which these articles belong are actually in life. For instance, he will inject boric acid into the veins of a sheep. The natural circulation of the blood will carry the antiseptic through every part of the body, and when the unfortunate animal that thus innocently preserves its own flesh for future consumption comes under the care of the butcher, it will be found that the mutton will keep perfectly wholesome for a considerable period. An invention which has a more practical ring about it comes from Berlin in the shape of an iron chess-board fitted with magnetized pieces. In transatlantic traveling this singular chess-board will be appreciated by weary travelers if, as the inventor claims, the pieces will retain their position even if the ship heels over.

GENERAL INTELLIGENCE.

☞ *We solicit and are always pleased to publish in these columns any items of interest that may be furnished us.*

GAS AND WATER.

IMPURE WATER.—Toronto is in trouble in regard to the impurity of its water.

YONKERS WATER-WORKS.—The report for 1881-82 is received. The Engineer and Superintendent, W. W. Wilson, states that the works were never in better order than at present. A new Worthington duplex pumping engine has been added during the past year, and the system of distribution has been increased to an aggregate of 23.4 miles of pipe. There are 250 hydrants, 154 gates and 496 meters. The daily consumption has been 840,000 gallons. The total rain-fall for the year has been 39.89 inches, of which the greatest, 6.78, was in June, 1881, and the least, 1.02, in September. The total receipts for the year were $22,562. The cost to pump, distribute and pay interest per 100 cu. ft. for the year was 13.30 cents.

GAS-WORKS AT NEWPORT, O.—Speaking of the City Council a local paper says: "This body will meet to-night, and, among other things that will come up for their consideration, is the gas question. It certainly is the observation of every intelligent person, that in towns and cities gas-works are always located near some river or stream, and at points least offensive and obnoxious to their inhabitants, and where the ground is of little value. One reason for this is to give facilities for dispensing of the refuse from all works of this kind. We have located in this city a coal gas-works without any facilities for disposing of its refuse in that portion of our city, which, in the near future, should become the most populous, and the ground the most valuable of any, and yet the owners of property and residents of that vicinity have allowed the erection of works the most offensive and noxious of any, without a thought of the future effect it will have on their property and homes. If any of the company or individuals than the proportion referred to had purchased the ground upon which it stands and proposed to erect coal gas-works thereon, these same property owners would have become alarmed and have entered a protest, and, perhaps, would have appealed, and properly, too, to the legal authorities for protection against the erection of what is bound to become an intolerable nuisance."

WATER-WORKS TALKED OF.—The question of village water-works at West Rutland, Vt., is being agitated, water to be taken from the brook above A. J. Mead's residence.

GAS WORKS PURCHASED.—J. K. Graves, of Dubuque, has purchased the Iowa City gas-works, the consideration being $80,000.

YORKVILLE, CANADA, WATER SUPPLY.—A late issue of the *Toronto Mail* states that the people of Yorkville are about to be compelled to face an unanticipated contingency in the shape of the exhaustion of their water supply. Nordheimer's creek, which has been the source of supply for many years, is fast dwindling into a mere rivulet, and the fear is felt in many quarters that but a short time must elapse before the creek will be *non est*. At the present time there is no water in the reservoir, and the supply has to be obtained direct from the engine. It cannot, in the natural order of things, last long, and the question now agitating the people is, Where are we going to get our water from? Annexation to Toronto is suggested as a remedy. Inquiries are being made in regard to artesian wells.

ELECTRICITY.

RICHMOND, Va., longs for the electric light, and the longing is in a fair way of being satisfied.

ELECTRIC LIGHT IN WASHINGTON, D. C.—F street is illuminated by electric lights of the Heisler Electric Light Company.

THE STILLWATER (MICH.) ELECTRIC LIGHT COMPANY is holding back to see how the experiment works in St. Paul.

ELECTRIC LIGHT COMPANY.—Articles of incorporation of the Racine (Wis.) Electric Light and Power Company were filed June 29. Capital stock, $16,000. They will furnish light for Racine and other cities if able to secure contracts.

TELEGRAPH WIRES IN EUROPE.—In Paris the telegraph engineer lays his wires in lead pipes fastened to the tops of the arches of the drains. In Germany the exigencies of war and of climate led to the completion of the underground system of telegraph wires two years ago. In Vienna both telegraph and telephone lines are carried on brackets along the fronts of the houses.

SAVANNAH, COLUMBUS AND MACON, Ga., have each a Brush Electric Light and Power Company. Capital, $100,000.

STREETS, DRAINAGE, ETC.

CEDAR BLOCKS will be tried on two streets in Toronto.

ST. LOUIS has let several contracts for street work.

DRAINING LAKE OKEECHOBEE.—The company engaged in draining Lake Okeechobee, in Southeastern Georgia, reports that the work is progressing satisfactorily. The dredge boats in use are fitted with all the modern appliances, and are the most complete of any ever introduced into the State. During the past five months as many miles of canal have been constructed, and it is expected that it will soon enter Lake Hichpochu, which is separated from Okeechobee by a strip of land of about three miles in width. The drainage of the lake is looked forward to with considerable interest on account of the almost universal supposition that there are vast beds of coal underlying its waters.

RIVERS AND HARBORS.

THE Mississippi river has broken the Madison levee, eighteen miles above St. Louis, overflowing twenty thousand acres of farming land in Madison county, and floating away the stacked wheat.

CINCINNATI, O., July 3.—Special dispatches from St. Joseph and Booneville state that the Missouri river is very high and rising rapidly. At the former place it was 21 feet and rising, and at the latter 20 feet and rising, having risen 20 inches in a few hours yesterday afternoon.

NOTHING FOR THE POTOMAC FLATS.—The Senate committee on Commerce has declined to agree to the proposition to incorporate the bill for the reclamation of the Potomac Flats in the river and harbor bill as a amendment.

CAPTAIN EADS' PLAN ACCEPTED.—The Mexican Government has accepted Captain Eads' plan for the improvement of Vera Cruz harbor, to cost $7,500,000.

CONSIDERING THE RIVER AND HARBOR BILL.—Washington, July 4.—The Committee on Commerce nearly finished to-day its consideration of the river and harbor bill. An amendment was adopted by a vote of six to two to increase the appropriation for the improvement of the Mississippi River, between Cairo and the head of the passes, to $5,000,000. This adds to the House bill the $1,000,000 asked for by the Mississippi Commission to close the gaps in the levees caused by the recent flood. $100,000 was also added to the House bill for the improvement of the Missouri River. Amendments were adopted appropriating $250,000 for the improvement of Beaufort harbor and of various rivers in North Carolina, and $100,000 for beginning the construction of the Hennepin Canal in Illinois. The amendments made by the Senate committee will add to the bill as it came from the House about $2,000,000, making the total to be appropriated more than $19,000,000. The committee hope to finish the bill to-morrow and report it to the Senate on or before Thursday.

RAILROADS.

A SURVEYING party is now engaged in exploring a route for a line to connect the Virginia Midland Manassas Branch ending at Strasburg, Va., with Senator Davis's West Virginia Central & Pittsburg Railroad.

THE progress in the North River Tunnel on the Jersey side for the last week has been 26 ft. The whole distance completed there is 1,172 ft. The crown-plates of the work on the New York end have been advanced in the same period 8 ft.

NORTHERN PACIFIC RAILWAY.—Meanwhile the North Pacific, under its new management, is more than fulfilling all its promises. Last winter was very mild and open. Work was scarcely interrupted. The end of the track is now 125 miles west of Glendire, the terminus of last season, the Big Horn tunnel and bridge are just completed and the road bed is ready for the rails 179 miles further. By the first of October, when the great bridge at Bismarck will be completed, the track will be laid to the eastern foot of the Bozeman range, where it is liable to remain till another season to await the completion of the tunnel at that point. It is only a little over 100 miles from Helena, and all the grading will be completed this season ready for the rails from the east. The tunnel through the main range near Helena is much further advanced than the Bozeman tunnel. The drills from the east end are in about 700 ft. already. The drilling is done by steam and lighting by electricity. Soon drilling will be in progress from the west and in the centre, so that there will be no delay here. We are as liable to see the cars from Portland, Or., first as those coming from the east. There is a large force of men at work at both ends and along the entire route, probably fully 10,000, and most of the work in modern railroad building is with horse-power. From the west the track is about to the western limit of Montana, and all the grade that remains to be built is in Montana. This will be nearly or quite completed this season and for the completion next year there will be only the track laying, with some tunneling and bridge building. If we have another as mild winter as the last, the track may be all laid by July, but it is not surely expected till September or October. As the investment crawls up above 50,000,000, there gets to be a powerful motive to hasten the completion. When the North Pacific reaches Helena, we shall be just 1,565 miles from Chicago, by way of St. Paul; about the same distance as Ogden, which is 450 miles south of here by the Utah Northern, nearer Chicago by at least 300 miles, than by the Oregon branch of the Union Pacific. On the west we shall be within about 800 miles of Portland, and 1,300 miles of San Francisco. Helena certainly is well situated to make a city as large as Denver. The sight of so much work going on about us and the promise of so much more has created something of a boom in real estate. Lands that a few weeks ago could have been bought for less than $10 per acre cannot now be had for $100. Three new banks have organized in Helena this spring under the national system. We wish we could add that a thousand new residences and buildings were going to be erected this season, but labor and building materials are too high to allow any such hope. Eastern mechanics are coming in, however, and doing better work at lower rates. There is a fine field here for master builders, contractors and material men with some capital and plenty of energy. Our old dealers cling to their accustomed high prices to the last, but their days are numbered and they must retire before

those who will do more and better work on a narrower margin of profit.—*Correspondence Springfield Republican.*

C. H. PRESCOTT has sold the Tawas & Bayles Railroad to General Alger, George P. Smith and others, who will extend it within thirty days to East Tawas, Mich., and also extend it up to the pineries by July 11.

LONDON & NORTHWESTERN RAILWAY.—A pretty big concern is the London & Northwestern Railway of England, with its 1,700 miles of line and principal termini at London, Liverpool, Holyhead and Carlisle, with connections to Edinburg and Glasgow. Its capital is about $500,000,000, and there are 40,000 persons employed to operate it. The management is in the hands of a board of thirty directors, who attend to details through various committees—and no member of the board is allowed to speculate in the stock. Every member is expected to give the most of his time to the road one week in each month. Many improvements have recently been introduced for the comfort and convenience of travelers, one of which is the checking of baggage so that it will be delivered to the owner's address at the destination.

RAILWAY PROGRESS IN TEXAS.—At the close of work, July 2, on the Fort Worth & Denver City Railway, the end of the track was at a distance of 90 miles from Fort Worth. The business of the road is good, and continues to increase. Crops along the line are splendid.

THE ASHLAND RAILROAD COMPANY have filed articles with the Secretary of State of Wisconsin, the capital stock being $100,000, divided into 1,000 shares of $100 each. The road contemplated is to be constructed from a point of junction with the Chicago, St. Paul, Minneapolis & Omaha Railway, in the county of Bayfield, and will extend to and beyond the village of Ashland, in the county of Ashland. The length of the road will be about 10 miles. The directors for the first year are E. W. Winter, of St. Paul; W. H. Phipps, J. C. Spooner, C. W. Porter and D. B. Taylor, of Hudson.

THE B. & O. R. R.—The Chief Engineer of the Burlington & Ohio Railroad Company has commenced locating the line of the road from Gillespie to Carlinville, Ill. A full corps of surveyors are in the field, and it is said that the work will be pushed to early completion. The following officers were elected at the meeting of the stockholders: W. C. Shirley, President; George P. Merrill, First Vice-President and General Manager; James Walker, Second Vice-President; M. McClure, Treasurer; L. C. Giessner, Secretary; W. F. Garis, Chief Engineer; R. Towner, Acting Auditor and Cashier; Robert Shirley, Solicitor. The first section of 10½ miles, from Carlinville and Gillespie, will be contracted for at once.

RAILROADS IN BRAZIL.—The total extension of railways under traffic in the empire is 4027½ kilometers. Of this extension 1,103½ kilometers belong to the state, and 637 are operating under government guarantee. The total capital guaranteed by the state is 167,862,-572$473, or, excluding the Sao Paulo railway, 144,306,-722$473. Of this aggregate $16,000,000$ is guaranteed at 6 per cent., and the rest at 7 per cent.—*The Rio News.*

CONSTRUCTION IN MICHIGAN—EAST TAWAS, Mich., July 3.—Surveyors are at work on the extension of the Tawas and Bay Company railroad from Tawas City to this place, and will probably assume the right of way granted to the Alpen Bay City railroad. The machine-shops and round house are to be moved from Tawas City to this place this week. It is reported that all mills here will shut down and men be put on the road to hurry it through.

THE ATLANTIC & PACIFIC.—A note from Boston states that the following telegram was received by Col. H. C. Nutt, President or the Atlantic & Pacific Railroad company:

ALBUQUERQUE, July 1, 1883.—This day at 3:37 p. m. the first locomotive passed over the Canyon Diabollo bridge. One hundred and eighty miles of road-bed are ready for the track, and the contractors are pushing forward. Over two hundred miles of still rails are on hand and cross-ties to lay the great Colorado river. The track forces are ready, the material moving, and track-laying will commence at once. In a few days the track will be in reach of Prescott business, and the gold, silver, and copper mines, and pine forests at Arizona. There is considerable activity in the coal fields. Six mines are already opened and delivering coal. Everything is in readiness to go forward rapidly.

LEWIS W. CLEMENT,
Chief Engineer Atlantic & Pacific Railway.

A NARROW GAUGE SCHEME.—There is a rumor that a charter will be asked for a narrow-gauge railroad from Keene up the valley of the Ashuelot, through the towns of Surry, Gilsum and Marlow.

SUCCESSFUL BOND NEGOTIATIONS.—A cable dispatch from Gen. Palmer, President of the Mexican National Railway Company, now in London, announces his successful negotiation of $10,000,000 bonds of that company, which will immediately complete the entire main line from Laredo to the City of Mexico. This is the largest American loan negotiated in London since Garfield was shot.

A NEW HAMPSHIRE N. G. PROJECT.—There is talk at Keene of a narrow-gauge road up the Ashuelot valley through Surry, Gilsum and Marlow.

A NEW LINE OF ROAD.—A note from Milwaukee dated the 29th ult. says: Day before yesterday contractors began grading at several points along a line of road from Red Wing to Northfield *via* Canon Falls, Minn. This new line, the survey of which was completed several weeks since, is intended by the Chicago, Milwaukee & St. Paul Railway Company to furnish a short connection between their river and Iowa and Minnesota divisions. The right of way has been mostly obtained, and the road will be pushed to completion this fall. The length of the line is thirty miles. When completed it will effect a saving of forty miles between the two divisions.

A NEW WISCONSIN RAILROAD.—The Ashland Railroad Company has filed articles of incorporation; capital $100,000. The road will be ten miles in length, commencing at a point on the Omaha railway at section 10, range 47, in Bayfield County, running to Ashland, Wis. The construction of the road is likely to commence soon.

BUYING STEEL RAILS.—The general manager of the St. Paul, Minneapolis & Manitoba Railway has purchased 3,500 tons of steel rails, for immediate use at various points on the line of the road.

TEXAS SURVEYS COMPLETED.—The surveying and locating engineers of the Gulf, Colorado & Santa Fe Railway have completed their surveys of lines of the East Texas branch of the road to a point of junction with Bremond's Houston East & West Texas road. The junction is about 100 miles from the main line of the road.

THE EASTERN DIVISION OF THE CANADIAN PACIFIC.—TORONTO, June 28.—Mr. C. Hammond, Manager of the Sullivan & Marpoles section of the Canadian Pacific Railway, is here engaging men. This section extends from Algoma Mills 100 miles eastward, and there are now 750 men working on the first fifty miles. The country is very rocky and frequent blasting is required. At Algoma Mills the syndicate have constructed a large wharf. In the fall they intend to build an elevator and next summer a line of boats will run between that point and Chicago.

THE NEW YORK, TEXAS & MEXICAN railroad has been completed to Victoria.

MENOMINEE VALLEY ROAD.—MADISON, Wis., July 3.—Amended articles of association of the Menominee River Railway Company were to-day filed with the Secretary of State. The amendment consists in an increase of capital stock from $665,000 to $1,500,000, with the privilege of extending the line from its present terminus at Crystal Falls, Marquette County, Michigan, in a northeasterly direction, through the counties of Marquette and Barga to Keweena Bay, a distance of sixty miles.

PENNSYLVANIA R. R. CHARTERS GRANTED.—HARRISBURG, June 30.—Charters were issued to-day from the State Department to the following railroad companies: State Line, Brookland & Pine Creek Railroad Company, which proposes the construction of a narrow-gauge line, 20 miles long, in Potter County, with capital stock of $120,000; Goodrich H. Bush, of Westfield, Mass., president; Pike Mills & Kettle Creek Railroad Company, which proposes building a narrow-gauge railroad from Pike Mills, Potter county, to Westport, Clinton county, a distance of 40 miles; capital stock, $200,000; president, C. S. Bushnell, New Haven, Conn.; Sinnemahoning & Pine Creek Railroad Company, which is authorized by its charter to construct a narrow-gauge road 20 miles long, running along the west branch of Pine Creek to the source of the Sinnemahoning River, Potter County; capital stock, $200,000; president, Daniel D. Warren, Springfield, Mass.; Garfield & Cherry Grove Railroad Company which proposes the construction of a narrow-gauge road from a point on the Philadelphia & Erie Railroad, Warren county, between Sheffield and Tiona, to Garfield, a distance of 15 miles, capital stock, $200,000; president, Goodrich H. Bush, Westfield, Mass. This road is intended to accommodate the wants of the new Warren County oil field.

EXTENSION WORK.—Work on the extension of the Chicago, St. Paul & Minneapolis railroad in Wisconsin is progressing rapidly. The track is laid on the Superior branch to the St. Croix river. The work is to be prosecuted through to Superior City without interruption. This line, when completed, will be about 165 miles in length, from St. Paul to Superior City. On the Bayfield branch grading is in good progress, the ground being covered with graders. On the Chippewa Falls and Northern branch, from Bloomer north, the track is laid to Chetek, seventeen miles from Eau Claire. This line, when finished, will form the through route from Superior City to Eau Claire.

DULUTH & IRON RANGE RAILROAD.—Engineer Case, with a party of eighteen surveyors, left the city for Agate Bay yesterday forenoon. They will establish a camp and base for supplies at the bay, in charge of Thomas Sexton. From this camp the party will draw its supplies for the work of surveying and locating the line, which will now be pushed as fast as possible from both ends. The whole line from Duluth to Vermilion will be permanently located and estimated for before November. Mr. G. C. Stone has been in the city several days, superintending operations in person. Engineer Lee and party are making good progress from Vermilion this way, and have secured a good line. Mr. Stone's advices from the man in charge at the mines are of the most flattering nature, and more men and supplies have been sent up from Duluth this week. Everything at the mines is going well. That there is iron enough there to justify the building of a railroad, Mr. Stone has not a doubt.—*Duluth Tribune.*

THE W. & L. E. EXTENSION.—Norwalk, Ohio, July 4. The track-layers on the Wheeling & Lake Erie Railroad have reached Toledo, and trains can now run to that city. The line between that city and here is mostly ballasted, and, in a short time, will be ready for regular operation. Track-laying is being vigorously pushed from Massillon toward Zoar, where connection is made with the Cleveland & Marietta, its last acquisition. Work on the shops here is progressing steadily. The foundations are mostly laid, and work on the superstructure will begin this week. The line in operation from Huron to Massillon is doing a large and increasing business.

CANALS

THE PANAMA CANAL.—PANAMA, June 24.—Much rain has fallen here, and canal and other work outside may be considered as practically suspended.

PARIS, June 30.—The shareholders of the Panama Canal Company at the meeting held yesterday, approved the report of M. De Lesseps, and authorized the directors to issue obligations to the amount of £250,000 bearing five per cent. interest for the purchase of the Panama Railroad.

THE MURRAY CANAL.—The tenders received by the Railway Department for the construction of the Murray Canal are now being extended, and the action of the Government with respect thereto will be determined largely by the totals arrived at. It is stipulated that the foundation is to be ready by first of September, 1883; and the whole work is to be completed by the first of July, 1885. By the Engineer's measurement, the canal by the Presque Isle route will be six miles and a half long.

TUNNELS.

THE CHANNEL TUNNEL.—London, July 1. In the action of the Attorney-General vs. The Submarine and Continental Company, the Chancery Division has granted leave to serve notice of motion for Wednesday asking for an injunction and inspection. The object is to prevent further boring for the channel tunnel. Since the government objected to the further prosecution of the work, Sir Edward Watkin has obtained leave to continue the work necessary for the safety of life, but prevented the government inspectors ascertaining whether that purpose was not exceeded.

CONTRACTS LET.

CONTRACT FOR GRANITE BLOCK LET.—The city of Minneapolis has made a contract for 500,000 granite blocks for paving Washington Avenue.

SEWER CONTRACT LET IN LYNN, MASS.—The Committee on Drainage has awarded the contract for building 600 feet of sewer in Essex street, north of Ireson street, to J. C. Bond at $1.25 per foot; and for building 200 feet of sewer in Warren street, to A. T. Thurston for 83 cents per foot.

CONTRACTS.

AMONG the eminently successful devices for rapid tracklaying on railroads that have come into use within a few years, that of Messrs. McLennan & Holman, of 94 Dearborn street, Chicago, is justly noted. Their "Patent Railway Tracklayer" is now in use on the following railroads, to the engineers of which interested parties are referred for information: Chicago & N. W. R. R., E. H. Johnson, Chief Engineer; New Orleans Pacific R. R., C. C. Barr, Division Engineer; Detroit, Butler & St. Louis R. R., Gen. J. S. Casement, Contractor; Kansas City, Springfield & Memphis R. R.; Flint & Pere Marquette R. R.; Saginaw, Tuscola & Huron R. R.; Wheeling & Lake Erie R. R.; Louisville & Nashville R. R.; Cincinnati Southern R. R. Mr. Holman spent the winter months in the South, where he had good success in introducing his machines.

BUILDINGS.

A NEW HOTEL is soon to be built at Spirit Lake, Ia.

A NEW HOTEL will be built at Cass City, Mich.

Should no new building enterprises be commenced in Minneapolis this year, there is enough work on hand to keep builders and labor well employed for the rest of the season.

BUILDING PERMITS IN MILWAUKEE.—The total amount of building permits issued by the board of public works in Milwaukee during last week was $25,525, against $42,720 for the week previous, a decided decrease. The price of brick has gone down perceptibly, but it was so late in the season, that not the same advantage will be taken of the fact as earlier in the season, before builders had so nearly completed their plans for the season.

PLANS FILED IN THIS CITY.—On the 5th plans were filed by Hon. Thos. L. James, Pres't of the Lincoln Safe Deposit Company, for the erection of a structure for the company on the south side of Forty-second street, about 150 feet west of Fourth avenue. The building will be fire-proof, seven stories high, have a frontage of 100 feet and a depth of 97 feet, be built of Belleville stone and brick, and cost $300,000. John B. Snook is the architect.

LABOR.

STRIKING BRICKMAKERS.—Over 750 brickmakers in Denver have struck. The molders ask $3.50 per day, and the laborers $2.50.

BRIDGES.

A NEW IRON BRIDGE.—The Michigan Central Railroad company will soon build a new iron bridge across the St. Joseph (Mich.) river at Three Rivers. This bridge will have two spans of 120 feet each, and will cost from $12,000 to $14,000.

TO BRIDGE THE ARKANSAS AND MISSISSIPPI.—The President has approved the acts authorizing the construction of a bridge across the Arkansas River at Van Buren, Ark., and a bridge over the Mississippi River at New Boston, Ill.

THE Wrought Iron Bridge Company of Canton, Ohio, carry on works established in 1861. The present stock company was organized in 1870. About three acres of ground are occupied. The main building is 54 by 368 feet, one 100 by 150 feet, and another 50 by 150 feet. Sixteen forges are used, and one hundred and forty hands required in the works, and one hundred and forty employed at erecting bridges.

BRIDGE UNSAFE.—The pier of the new iron bridge at Goodhue Mills, Cannon Falls, Minn., is giving away on account of the high water, and the bridge has been declared unsafe.

MISCELLANEOUS.

JUDGMENT AGAINST THE ILLINOIS & ST. LOUIS BRIDGE COMPANY.—A judgment for $285,128.95 in favor of Christian T. Christensen, and against the Illinois & St. Louis Bridge Co., was filed in the County Clerk's office, this city, on the 5th inst.

PATENTS.—The total number of patents issued on the 5th by the United States Patent Office was 419, of which 381 were new patents, 5 designs, 22 trade-marks, 5 labels, and 6 reissues of patents. During the fiscal year just ended there were 46,633 agricultural patents issued from the General Land Office. This is an increase over the issue of the previous year of 20,033 patents.